PB90-206327

Direct/Delayed Response Project: Mid-Appalachian Soil Correlation and Sampling Class Development Workshop Held in Corvallis, Oregon on August 22-25, 1988

(U.S.) Corvallis Environmental Research Lab., OR

May 90

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1. REPORT NO. EPA/600/3-90/037	2.
3.	PB90-206327
4. TITLE AND SUBTITLE Direct/Delayed Response Project: Mid-Appalachian Soil Correlation and Sampling Class Development Workshop	5. REPORT DATE May 1990
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Jeffrey J. Lee[1], Donald L. Stevens[2], Jeff Kern[2], and Duane Lammers[3]	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS [1]US EPA, [2]NSI, [3]USDA-FS, all at US EPA Environmental Research Lab, Corvallis, OR	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS US Environmental Protection Agency Environmental Research Laboratory 200 SW 35th Street Corvallis, OR 97333	13. TYPE OF REPORT AND PERIOD COVERED Published Report
	14. SPONSORING AGENCY CODE EPA/600/2

15. SUPPLEMENTARY NOTES
1990. US Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

16. ABSTRACT

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The soils identified during mapping were correlated and the sampling classes were defined at a workshop held in Corvallis, Oregon, Aug 22-25, 1988. This report documents the process and results of the workshop, and the post-workshop allocation of sampling effort to sampling classes and watersheds.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD VA 22161

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 51
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

EPA/600/3-90/037
May 1990

DIRECT/DELAYED RESPONSE PROJECT: MID-APPALACHIAN SOIL CORRELATION AND SAMPLING CLASS DEVELOPMENT WORKSHOP

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ACKNOWLEDGEMENTS

A draft of this report was reviewed by John Sencindiver, West Virginia University, William Edmonds, Virginia Polytechnic Institute and State University, and Leon Liegel, Environmental Research Laboratory - Corvallis. Ann Hairston and Amy Vickland provided editorial review and Deborah Coffey provided a quality assurance review. Carol Roberts was instrumental in producing the final report.

SECTION 1

INTRODUCTION

Through the Direct/Delayed Response Project (DDRP), the U.S. Environmental Protection Agency (EPA) is assessing the current and future effects of acidic deposition on surface waters (lakes, streams) in three regions of the eastern United States (Figure 1). The DDRP is being conducted under the National Acid Precipitation Program (NAPAP), a multi-agency federal task force. Church (1989) gave an overview of the project, and Church and Turner (1986) have given the details of the theoretical basis and approach of the DDRP.

One of the policy questions being addressed is:

> Within the regions of concern, how many surface water systems (lakes, streams) might become acidic (on an average annual basis) due to current or altered levels of acidic deposition, and on what long-term time scales (years to decades)?

As an essential step toward performing the analyses necessary to address this question, the DDRP acquired data on soils that were mapped, sampled, and analyzed using standardized methods in all three study regions. The mapping and sampling were done in cooperation with the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS). An overview of soil survey activities within DDRP was given by Lee et al. (1989a). The watersheds chosen for characterization in the Mid-Appalachian region (Figure 2) included all watersheds from "Regions 2CN" and "2BN", and some of the watersheds of "Region 1D" of the National Stream Survey (EPA, 1985) that met the following criteria:

1. watersheds of < 3,000 Ha area;
2. stream water acid neutralizing capacity < 200 μeq L^{-1}; and,
3. minimal watershed disturbance, especially from mining.

The approach used by DDRP was to group the soils identified during mapping into regional sampling classes. The classes were expected to have similar chemical and physical characteristics with respect to their responses to acidic deposition. A randomized design was used to select pedons for sampling. Several pedons in each sampling class were described and sampled to determine the means and variances of the characteristics of each sampling class. These regional means and variances were then used in conjunction with the soil maps to build area or volume weighted estimates, with error estimates, of each watershed's soil characteristics. Thus, the purpose of the sampling classes was to attain adequate resolution of soil properties, while limiting the sampling effort to a practical number of pedons.

Sampling classes had previously been defined for the Northeast Region (NE) (Lee et al., 1989b) and the Southern Blue Ridge Province (SBRP) (Lammers et al., in preparation). Field mapping activities were completed in the Mid-Appalachian Region in July 1988. The Mid-Appalachian Soil Correlation and Sampling Class Development Workshop marked the transition from soil mapping (Lammers et al., 1988) to soil sampling (Kern et al., 1988) in the region. Participants (Appendix A) included the SCS soil scientists from Pennsylvania and West Virginia who had the greatest responsibility for DDRP mapping and sampling; a representative of the SCS National Quality Assurance staff; DDRP scientists and statisticians; and other scientists with related interests.

The workshop was held August 22-25, 1988 in the LaSells Stewart Center at Oregon State University, Corvallis, Oregon. The workshop began with a brief overview of the DDRP presented by Jeff Lee of the EPA's Environmental Research Laboratory-Corvallis (ERL-C). The remainder of the first two days was

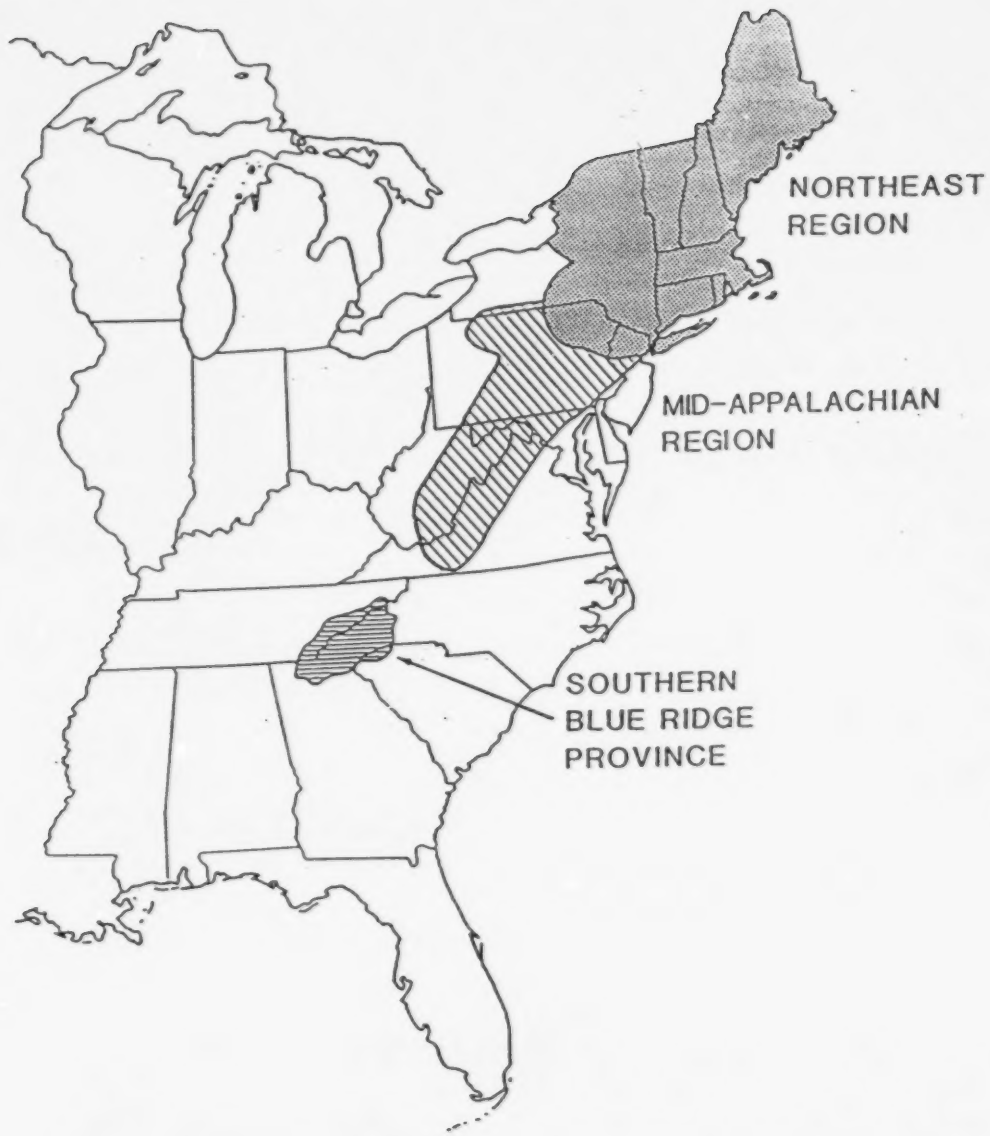

Figure 1. Study regions within the Direct/Delayed Response Project.

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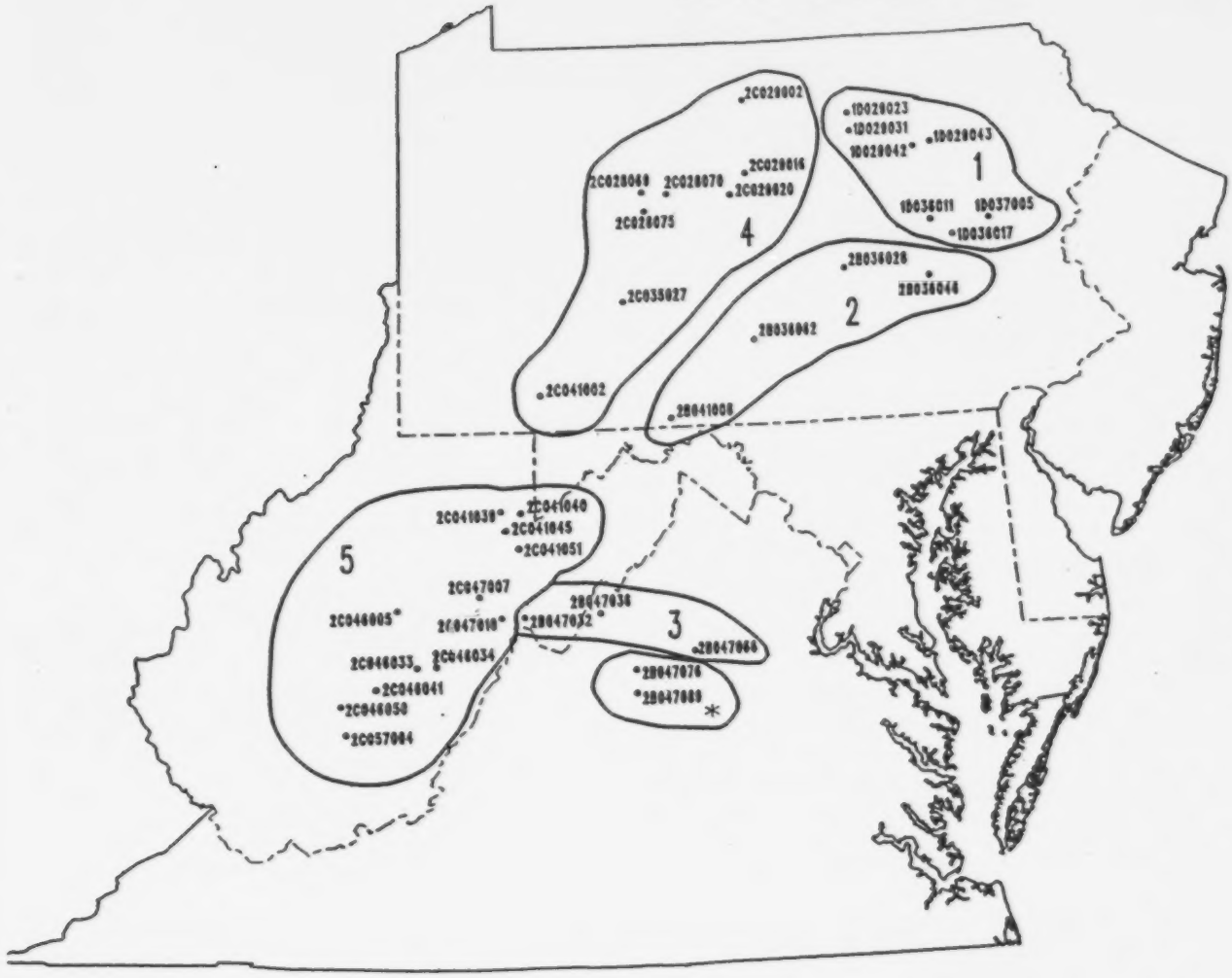

Figure 2. Direct/Delayed Response Project watersheds within the Mid-Appalachian Region. Solid lines indicate geographic groups of watersheds using during allocation of pedons to watersheds for sampling. Asterisk (*) indicated Piedmont/Blue Ridge watersheds. See Section 5.

dedicated to soil correlation (Section 2), led by Duane Lammers (ERL-C). The third day began with talks by Robb Turner (Oak Ridge National Laboratory, ORNL), Mark Johnson (ERL-C), and Paul Shaffer (ERL-C) on the effectiveness of sampling classes in the NE and SBRP, on cation supply, and on sulfate retention, respectively. The sampling classes were developed during the remainder of workshop (Sections 3 and 4), led by Jeff Lee. The final allocation of pedons to sampling classes and watersheds was accomplished after the workshop, as described in Section 5.

SECTION 2

SOIL CORRELATION

The objective of the workshop's correlation segment was to produce a correct and consistent mapping database. Included in this task were: correlation of soil taxonomic units and soil map units, resolution of map unit composition, specification and entry of missing soil component and map unit attributes, verification of soil component and map unit data, and correction of map discrepancies.

Corrections to the mapping database were made using a DBASE III+ Mapping Data Management System (Lammers et al., 1987a). Then the data were printed for editing by workshop participants. These updated files were used during the sampling class development segment of the workshop to sort soil components into proposed sampling classes and, following the workshop, to allocate pedons to sampling classes and watersheds for sampling.

2.1 Soil Identification Legend

Before mapping began in the fall of 1987, a preliminary identification legend was prepared to guide the mapping throughout the region and entered into a computer data file. The preliminary legend was constructed from legends of existing soil surveys within Major Land Resource Areas (MLRA) in the DDRP Mid-Appalachian region. As in the other DDRP regions, a Regional Coordinator/Correlator (RCC) was responsible for maintaining quality and consistency of mapping across the Mid-Appalachian Region. Map units were added to the legend on the approval of the RCC. As expected, several map units initially listed on the legend were not used in the mapping.

Prior to the correlation workshop, the delineated area of each map symbol for each watershed was estimated by the SCS using dot-grids. (Final estimates of areas were made later using a GIS.) These estimates were entered into a watershed legend file. From this file a summary of map symbols, with total acres of each map unit in the region, was generated. The watersheds where the map units occurred were also listed on this printout. The estimated regional areas of the map units were merged with the preliminary identification legend file (see Appendix B).

Workshop participants first reviewed the preliminary legend to verify that all map units used were listed. Five map units were added to the legend, and map units not used were marked for deletion. The map unit correlation resulted in about 60 changes to the legend. Approximately 15 corrections were made to the phase part of map unit names (e.g., Mandy channery sandy loam changed to Mandy silt loam). The name of a major soil was either added to or deleted from the name of 18 map units (e.g., 94C, Wellsboro channery loam, was changed to Wellsboro-Lackawanna channery loams).

Other small (< 20 acres) map units were combined with similar map units [e.g., 32C (8 acres) was combined with map unit 32B]. Some small area map units were combined with map units named after different soil series (Table 1). Six of the map units listed in Table 1 were combined with a more extensive map unit that included the major component of the lesser unit (e.g., map unit 67B, Morris channery loam, has a 10 percent inclusion of Norwich channery loam). The two very small acreage map units of Allegheny, 2B and 134B, were cartographically combined with dissimilar but geographically contiguous map delineations.

Other changes involved the correlation of taxonomic units, whereby a different soil series was determined to better represent the soil (e.g., map unit 27A, Chewacla, was changed to Codorus). All corrections, additions, and deletions were recorded in a comments field of the legend data file as listed in Appendix B of this report. The corrected legend was printed from the data file, examined and the discrepancies were corrected.

Table 1. Small area map units combined with more extensive map units named after different soil series.

Map Unit Code	Name	Hectares	Combined with map unit Code	Name
2B	Allegheny Silt Loam	1.6	18C	Buchanan Cn Silt Loam
134B	Allegheny Loam	0.8	36C	Ernest Silt Loam
33E	Dekalb Cn Loam	3.6	46E	Hazleton Cn Loam
66B	Monongahela Silt Loam	2.4	18B	Buchanan Cn Silt Loam
72B	Norwich Cn Loam	6.9	67B	Morris Cn Loam
76A	Pope Loam	3.6	31A	Craigsville Gr Sandy Loam
88B	Tunkhannock Gr Loam	3.2	98B	Wyoming Gr Sandy Loam
136C	Sensabaugh Gr Silt Loam	4.5	31A	Craigsville Gr Sandy Loam
	Total	26.6		

Notes: Cn = channery
Gr = gravelly

2.2 Map Unit and Soil Component Attributes

During mapping, SCS soil scientists conducted transects of most map units on every watershed (Lammers et al., 1988). The transects were identified by watershed number, soil map symbol, and transect number. The transect number corresponded to that assigned to each available transect (one or more for each delineation) for a map unit in a watershed. For each of the 10 equally spaced stops along the transect, the soil name, slope gradient and additional notes were recorded.

Data for 308 soil map unit transects, collected by SCS soil scientists, had been entered into a computer data file prior to the workshop. Workshop participants used these data, field notes, and observations made during the field mapping to adjust map unit composition. The proportion of major and minor (i.e., inclusions) soils and miscellaneous area components in each map unit was estimated to the nearest 5 percent.

Corrections to map unit composition were recorded on worksheets (Figure 3) that had been generated from the mapping data management system before the workshop. The corrections were entered into the data file, and the worksheets printed and were reviewed again during the workshop. (The map unit composition file and the watershed legend file were used to generate Table 7 for the allocation of pedons for sampling discussed in Section 5.)

Every map unit component in the map unit composition file was assigned a code (SCODE in Figure 3.). Each of these soils or miscellaneous areas was listed in the soil component file, along with selected soil characteristics and taxonomic classification. Soil properties recorded in this file, along with the soil name, texture, slope and other phase(s), included permeability, drainage, mode of deposition, origin of parent material, depth to bedrock and depth to a slowly permeable or impermeable layer. The initial soil component file was composed of data entered for major components of map units in the preliminary legend and the components added during mapping. SCODES were compared and those with no area mapped were deleted. As a result, soil components not used in the composition file were deleted from the components file. Components were added during the workshop using the mapping data management system, and participants examined a printed copy of the file for completeness and discrepancies.

The taxonomic classification of each soil series was checked against the national soil series classification list or the most recent copy of the official series description. The information in this file was used to sort soil components into soil sampling classes developed during the sampling class segment of the workshop.

Selected landscape attributes of map units were recorded in the map unit file. These included regional landform, local landform, geomorphic position, slope shape across and slope shape down. Entry codes used with the SCS pedon description program were used to enter these data. A printed copy of these attributes, along with the map symbol and map unit name, was reviewed and corrected or completed by soil scientists from the state responsible for the map unit. Corrections and additions were entered into the data file and the file was again listed and reviewed.

Following the workshop, the soil name at each transect stop was compared to the same name in the components file and the corresponding sampling class code in the transect file was replaced with the sampling class code from the components file. By doing this, a sampling class was assigned to the soil at each stop in the transect file. In this manner, misspelled soil name entries and soils that were not in the components file were identified by blank data in the sampling class field of the transect file. These data were reviewed and corrected on the printed copy of the transect file by soil scientists representing each state in the Mid-Appalachian Region. Corrections to the data file were made and any remaining discrepancies were resolved by the Mapping Task Leader and field soil scientists. As part of the mapping quality assurance program, transect data for the Mid-Appalachian Region will be statistically analyzed with respect to map unit composition. The transects of selected map units will be compared with transects conducted by the RCC. Analyses of transect data for the NE and SBRP were described by Lammers et al. (1987b,c).

MAP SYMBOL / MAP UNIT NAME 09/05/88
14F BERKS-WEIKERT CHANNERY SILT LOAM 35-70% SLOPES

REGIONAL LANDFORM: MINS or DP DIS PLAT
LOCAL LANDFORM: HILLSIDE or MINSIDE

GEOMORPHIC POSITION: BACKSLOPE SIDESLOPE
SLOPE SHAPE ACROSS: UNDULATING
SLOPE SHAPE DOWN: PLANE

	COMP%	COMPONENT NAME	TEX MODI	TEXCD	SLOPE	OTHER1	OTHER2
1.	50	BERKS	CN	SIL	35-70		
2.	35	WEIKERT	CN	SIL	35-65		
3.	5	BEDINGTON	CN	SIL	15-25		
4.	5	DEKALB	CN	L	35-65		
5.	5	CALVIN	CN	SIL	35-65		
6.							
7.							
	100						

	PARENT MATERIAL MODE OF DEPOSITION	PARENT MATERIAL ORIGIN	SMP CLASS	SCODE
1.	RESIDIUM	SANDSTONE-SHALE	BMK	32
2.	RESIDIUM	INTERBEDDED SDMENTRY	BNS	210
3.	RESIDIUM	SANDSTONE-SHALE	TWD	25
4.	RESIDIUM		BMK	78
5.	RESIDIUM	SANDSTONE-SHALE	BMK	50
6.				
7.				

	EST DEPTH TO BEDROCK	EST DEPTH TO IMPERMEABLE LAYER
1.	50-100	84
2.	25-50	46
3.	>150	>150
4.	50-100	86
5.	50-100	86
6.		
7.		

	PERMEABILITY	DRAINAGE	HYDROLOGIC GROUP
1.	MODERATE	WELL DRAINED	
2.	MODERATELY RAPID	SOMEWHAT EXCESSIVELY DRAINED	
3.	MODERATE	WELL DRAINED	
4.		WELL DRAINED	
5.	MODERATE	WELL DRAINED	
6.			
7.			

	SUBGROUP	GREAT GROUP	PARTICLE SIZE
1.	TYPIC	DYSTROCHREPTS	LOAMY-SKELETAL
2.	LITHIC	DYSTROCHREPTS	LOAMY-SKELETAL
3.	TYPIC	HAPLUDULTS	FINE-LOAMY
4.	TYPIC	DYSTROCHREPTS	LOAMY-SKELETAL
5.	TYPIC	DYSTROCHREPTS	LOAMY-SKELETAL
6.			
7.			

	MINERALOGY	REACTION	TEMPERATURE REGIME	OTHER
1.	MIXED		MESIC	
2.	MIXED		MESIC	
3.	MIXED		MESIC	
4.	MIXED		MESIC	
5.	MIXED		MESIC	
6.				
7.				

Figure 3. An example of a map unit description worksheet.

SECTION 3

SAMPLING CLASS DEVELOPMENT

The objective of the sampling class development segment of the workshop was to develop a key that could be used to assign every soil on the DDRP watersheds in the Mid-Appalachian region to a unique sampling class. These classes would then be used to decide which soils to sample and where to sample them. Within the context of the DDRP in the Mid-Appalachian region, all soils in a given class would be considered to be similar. Sampling crews would judge a soil to be correct or incorrect for sampling on the basis of the sampling class, not by which series it represented. The role of sampling classes in DDRP is described by Lee et al. (1989a).

To stimulate and focus discussion, workshop participants were asked to rate soil characteristics according to their importance for the effects of acidic deposition on Mid-Appalachian streams (Table 2). This was done just before and after the talks by Turner, Johnson, and Shaffer. The results of the first rating are given in Table 3. About half of the participants rated taxonomic classification (Order, Great Group, Subgroup, Series) as "1" or "2" in importance. Among the soil characteristics, family particle size, mineralogy of parent material, organic versus mineral soils, and drainage class were considered very important (i.e., 12 or more ratings of "1" or "2"). Texture, depth to bedrock, organic content of mineral soils, and depth to impermeable layer were considered moderately important (9-11 ratings of "1" or "2"). The results for the second rating (also in Table 3) were similar. One difference was that the perceived importance of texture was lower after it was made clear that this referred to surface texture. Another difference was that the perceived importance of drainage class, hydrologic group, and mode of deposition of parent material decreased, and that of regional physiography increased after the talks. These two sets of ratings represent the perception of important soil characteristics as it evolved during the early part of the workshop.

After the second rating of soil characteristics, there was general agreement as to which soil characteristics were important, but also a divergence of views as to the best approach for grouping soils according to these characteristics. To proceed further, participants were split into two groups to develop schemes for grouping soils into sampling classes. One group was asked to focus on "Major Characteristics", the other on "Taxonomic Classification". (This was similar to the procedure used to develop sampling classes for the NE; see Lee et al., 1989b.) Individuals assigned themselves to a particular group, with some re-assignment to ensure a balanced representation of states within each group. By the end of the third day, the two groups had produced the provisional schemes shown in Figures 4 and 5. The two groups then met jointly to discuss their schemes.

The major characteristics and taxonomic classification groups used the mapping data to list soil series by sampling class, and to estimate the occurrence of their proposed classes in the regions. Only major series (i.e., included in the name of at least one map unit) were included in this exercise. They also made some minor changes in the provisional schemes. The two groups then met jointly.

At this point the similarities between the two schemes were obvious. In fact, there were several classes in common among the two schemes. These included "Histosols" and "Organic Soils" (classes T21 and M1 in Figures 4 and 5, respectively); "Orthents" and "Mine Soils" (T11, M2); "Aquic Fluvents" and "Flooded Wet Mineral Soils" (T6,M11); and "Skeletal Spodosols and Moderately Deep Typic Dystrochrepts" and "Moderately Deep Non-Flooded Skeletal Mineral Soils" (T9,M4). Also, two of the classes in the "Major Factors" scheme (M6 and M7 in Figure 5) contained no soils. Furthermore, two shallow soils (Ramsey, Cleveland) did not fit any class in Figure 5. Workshop participants decided that even though these soils were non-skeletal, their shallowness fit best with the soils in M5; this created a class that was identical to T4 (Figure 4). Thus, at this point, of the 13 non-empty classes in the "Major Characteristics" scheme, five were identical to classes in the "Soil Taxonomy" scheme.

The need for the "coarse-loamy" versus "fine-loamy" branch (Figure 5) was discussed by the workshop participants. Elimination of the two empty sampling classes (M6, M7) left three coarse-loamy classes. One of these classes ("deep, wet;" M15) had three soils, of which two (Wellsboro, Wurtsboro) were somewhat

Table 2. Form used by participants for rating soil characteristics.

Possible Soil Characteristics for Defining Sampling Classes

Rate the following soil characteristics according to how important you believe they might be for the effects of acid deposition on streams. You do not have to rate every characteristic, and you may add others. Use 1 for most important, 5 for least important.

Rating	Characteristic
	Order
	Great Group
	Subgroup
	Series
	Slope phase
	Origin of parent material (mineralogy)
	Mode of deposition of parent material
	Organic vs mineral
	Organic content of mineral soils
	Family particle size
	Texture
	Depth to bedrock
	Depth to slowly permeable layer
	Regional physiography
	Local physiography
	Drainage class
	Hydrologic group
	Other:_____

Table 3. Ratings of possibly important soil characteristics by workshop participants. Entries are numbers of participants giving that rating. "First" and "Second" refer to ratings given before and after talks on sampling NE and SBRP classes, cation supply, and sulfate retention. Column labeled "6" contains numbers of participants who did not rate a given characteristic. Total number of participants was 17 for the first rating and 9 for the second rating.

Characteristic	Rating													
	First							Second						
	1	2	3	4	5	6	1+2	1	2	3	4	5	6	1+2
Order	2	5	1	6	2	1	7	0	5	0	1	2	1	5
Great Group	3	4	4	2	2	2	7	1	4	0	1	1	2	5
Subgroup	1	7	3	3	2	1	8	0	4	2	2	0	1	4
Series	3	4	3	2	3	2	7	1	3	1	2	2	0	4
Slope phase	1	2	5	6	2	1	3	1	1	3	3	0	1	2
Origin of parent material (mineralogy)	9	4	3	0	0	0	13	5	2	2	0	0	0	7
Mode of deposition of parent material	0	5	5	4	2	1	5	1	0	3	2	1	2	1
Organic vs mineral	11	1	2	2	0	1	12	7	1	0	0	0	1	8
Organic content of mineral soils	4	6	3	2	1	1	10	3	2	3	0	1	0	5
Family particle size	6	8	2	1	0	0	14	3	5	0	0	0	1	8
Texture	7	4	1	4	0	1	11	1	2	1	1	2	2	3
Depth to bedrock	8	3	4	1	0	1	11	2	4	2	1	0	0	6
Depth to slowly permeable layer	6	3	4	3	1	0	9	2	2	3	0	0	2	4
Regional physiography	0	0	2	3	7	5	0	2	1	0	2	2	2	3
Local physiography	1	1	5	4	4	2	2	0	2	3	1	0	3	2
Drainage class	5	7	3	0	0	2	12	2	3	2	0	0	2	5
Hydrologic group	1	4	5	3	1	3	5	0	0	1	4	2	2	0

Other characteristics listed by at least one participant:

Vegetation
Land use
Clay mineralogy
Areal extent
Aspect
Slope shape (convex vs concave)
Landscape position
Temperature regime
pH
pH dependent charge
Anion exchange
Fe and Al oxides

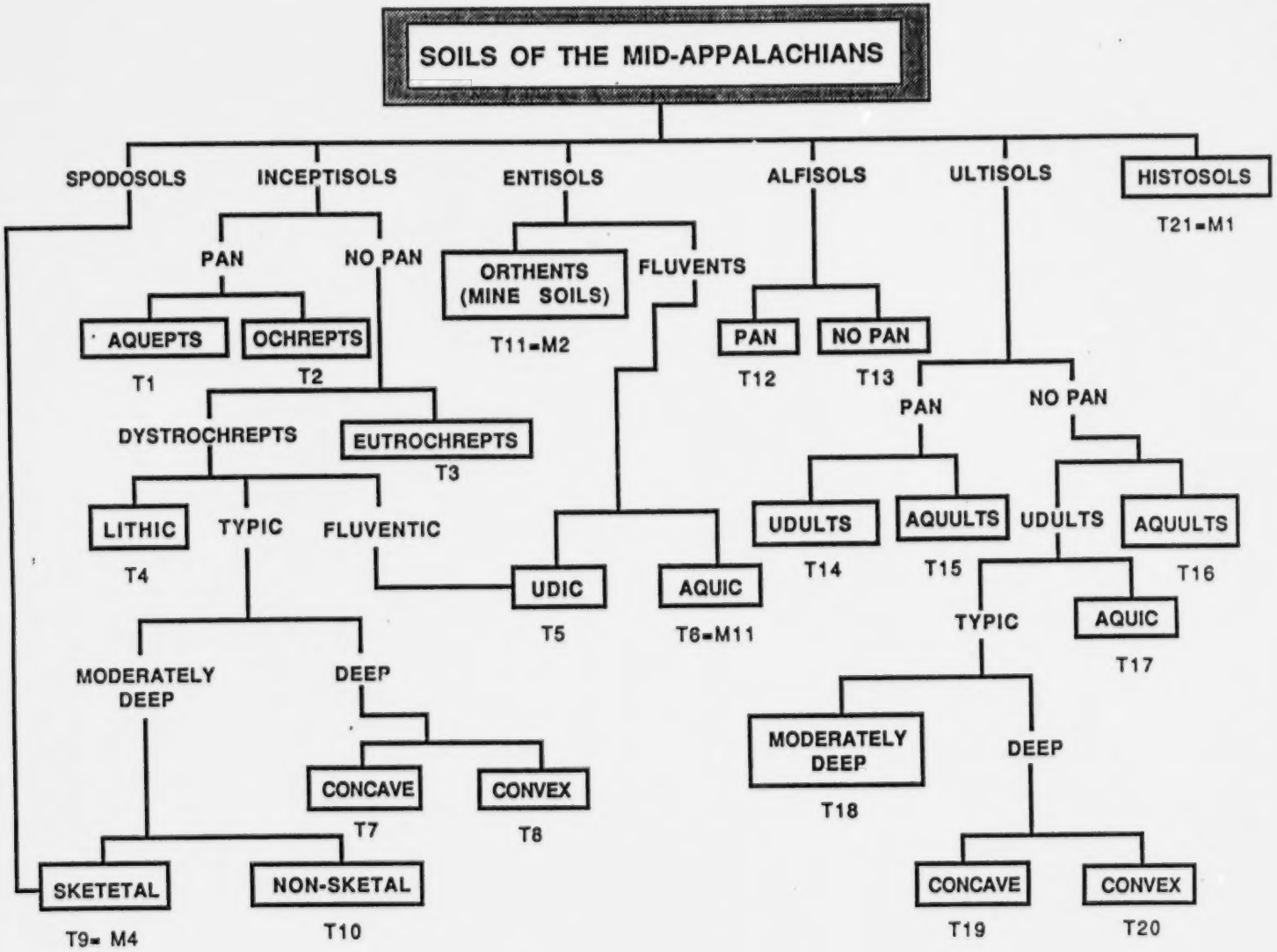

Figure 4. Preliminary sampling class scheme for the "Taxonomy" group.

poorly drained, but classified as Typic Fragiochrepts. Workshop participants decided that these soils were not very different from the Typic Fragiochrepts in M14. Moving Wellsboro and Wurtsboro to M14 left only one soil (Morris series) in M15. It was felt that the wetness and fragipan of this soil were much more important than family particle size, so that it could be placed with the more common "fine-loamy, deep, wet soils" (M8) (Figure 5). Some of the soils in class M8 were Aeric Fragiaquepts, as was Morris.

Elimination of M15 left one coarse-loamy sampling class (M14). Except for Lordstown, all soils in M15 were Typic Fragiochrepts. The workshop participants decided Lordstown was more similar to the no-fragipan soils in M10 (which included other Typic Dystrochrepts) than to the fragipan soils in M14. With this change, the fine-loamy versus coarse-loamy split differentiated only two classes, one containing only Inceptisols (M14) and the other containing only Ultisols and Alfisols (M9).

Now the major difference between the two schemes was that the "Major Factors" group had classes that mixed Spodosols, Inceptisols, Ultisols and/or Alfisols. After discussion, the workshop participants reached a consensus that the Ultisols and Alfisols could be grouped together. Both Orders have argillic (clay-enriched) horizons, and the differences in base saturation between them were not considered to be important for this project in this region. Similarly, there was consensus that the rare Spodosols (15 acres of Gauley) could be grouped with the Inceptisols.

There was no consensus as to whether Ultisols and Inceptisols should be grouped for this project. The "Major Factors" group felt that, in the region under consideration, argillic horizons generally were weakly expressed, so that the differences between these Orders were not important for DDRP. The "Taxonomic Classification" group felt that the presence or absence of an argillic horizon was an essential difference. The situation was resolved by using the guideline that it was best to split soils if they might be different for the purposes of DDRP. Thus, Inceptisols/Spodosols versus Ultisols/Alfisols was introduced as the last split of those "Major Factors" classes that contained Orders from both pairs (M3, M8, M10).

One of the classes that resulted from the split on Orders (M3 Ultisols/Alfisols) contained two relatively rare soils. One of these (Hartleton) occurred on a total of 125 acres on three watersheds. The other (Lew) occurred on only one watershed (490 acres). Most workshop participants felt that these soils were too rare to warrant a separate sampling class. For this reason, the Skeletal soils in M3 Ultisols/Alfisols were combined with the non-skeletal soils in M8 Ultisols/Alfisols.

The "Major Factors" group considered the final split on Orders to be unnecessary, but generally acceptable. There remained, however, a strong opinion within the "Major Factors" group that the skeletal soils should have been grouped together. The rationale was that rock fragment content was much more significant than the presence or absence of marginal argillic horizons in these soils. This was especially a concern for deep skeletal soils such as Hartleton and Hazleton. This opinion was not incorporated into the sampling class scheme, and should be considered when evaluating the classes from field descriptions and laboratory data.

At this point, the sampling classes for the two schemes were almost identical in terms of the specific soils they contained. The differences were in the priority of the branches, not (with one exception, discussed below) the final grouping of soils. The most obvious difference was that the "Major Factors" scheme branched on Order at both the beginning ("organic" versus "mineral" soils) and at the end (Inceptisols versus Ultisols) of the tree. The "Major Factors" flowchart was then redrawn to produce identical classes, but with all branches on Order coming at the top, including the new Inceptisols versus Ultisols branches. The final flowchart (Figure 6) was produced by combining the flooded, well-drained Entisols and Inceptisols (e.g., Udifluvents with Fluventic Dystrochrepts). (The symbols for the classes were developed after the workshop, using the mnemonic system in Table 4.)

Except for the unresolved question of skeletal soils (discussed above), the final scheme (Figure 6) was acceptable to both groups. It maintained the hierarchial relationships important to taxonomy, but modified these according to the soil characteristics considered most important for DDRP's purposes. Figure 5, with the modifications described above, remains important as a record of the priority assigned to each

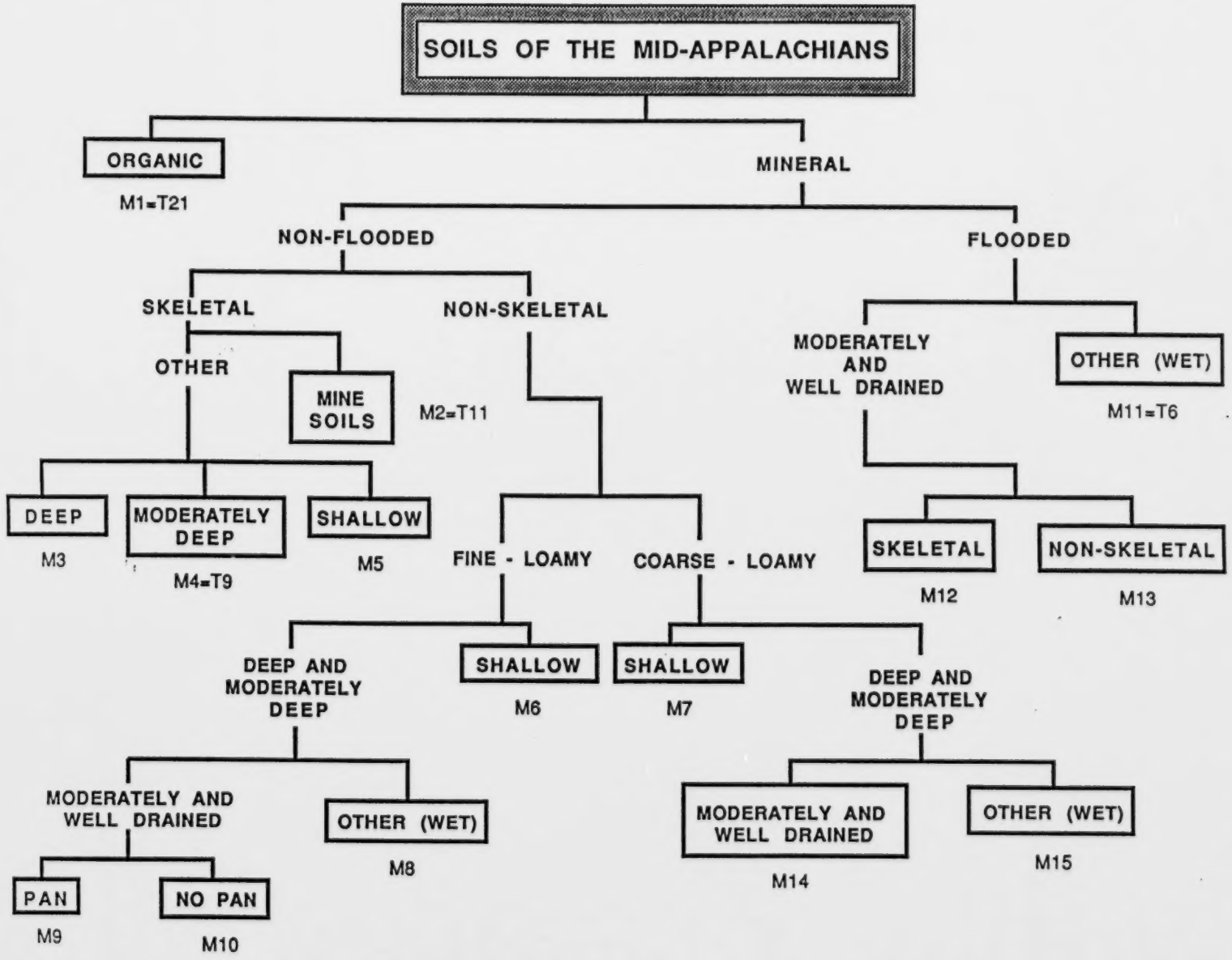

Figure 5. Preliminary sampling class scheme for the "Major Characteristics" group.

Table 4. Mnemonic system for naming sampling classes.

Symbol	Meaning	Mnemonic
HST	Histosols	Histosols
C	Entisols	C horizon, no B horizon
B	Inceptisols, Spodosols	B horizon
T	Ultisols, Alfisols	Argillic (Bt) horizon
X	Fragipan	Bx horizon
N	No fragipan	No Bx horizon
W	Well, moderately well drained	Well drained
P	Somewhat poorly drained and wetter	Poorly drained
S	Shallow	Shallow
M, MD	Moderately deep	Moderately deep
D	Deep	Deep
MS	Mine spoils	Mine Soils
F, FL	Flooded (Fluventic)	Flooded
K	Skeletal	Skeletal

characteristic by the "Major Factors" group, and should be consulted during evaluation of the classes from field and laboratory data.

A dBase III program was used on the revised mapping database to sort soils into sampling classes and to tally the areas for the classes. The list of soils was reviewed by the workshop participants, and a few soils were assigned to different classes (Table 5). For all but one soil, this was done by the expedience of changing the drainage class listed for the soil. One Inceptisol (Simoda) was reassigned to an Ultisol class, because it has a horizon that would be classified as argillic if the soil were not frigid. The final assignment of series to sampling classes is given in Table 6. Summary descriptions of the characteristics of soils within each group are given in Appendix C.

The changes in the assigned drainages of some soils (Table 5) made the branches on wetness in Figure 6 almost into branches on taxonomy, rather than drainage. With the new assignments, sampling class TXW contained only soils that were in aquic Subgroups, while TXP contained only soils that were in aquic Suborders (Aquents, Aquepts). Similarly, all soils in TPD were aquic at the Subgroup level, while only one soil (Wharton) in TWD and none in TWM was aquic. Furthermore, all soils in CFP were Aquents, while no soil in FLW was aquic at either the Subgroup or Suborder level of taxonomy. FLW did, however, contain Fluvaquentic Dystrochrepts. Thus, it seems that the workshop participants relied mainly on the taxonomic concept of aquic versus non-aquic soils to differentiate wetness, and used drainage mainly as an expedient method for sorting soils into groups by computer. This would be consistent with the approach used in the NE (Lee et al., 1989b). In that region, taxonomic criteria were preferred to drainage classes because they were considered to be better defined, more objective, and more consistently applied in the field.

By the close of the workshop, participants agreed that they had met the objectives of the workshop. The classes defined by Figure 6 could be used as the basis of the sampling design to acquire the soil data needed by DDRP. These data could be entered into the models and statistical analyses that DDRP would use to address the policy question stated in Section 1, as described by Church (1989) and Lee et al (1989a).

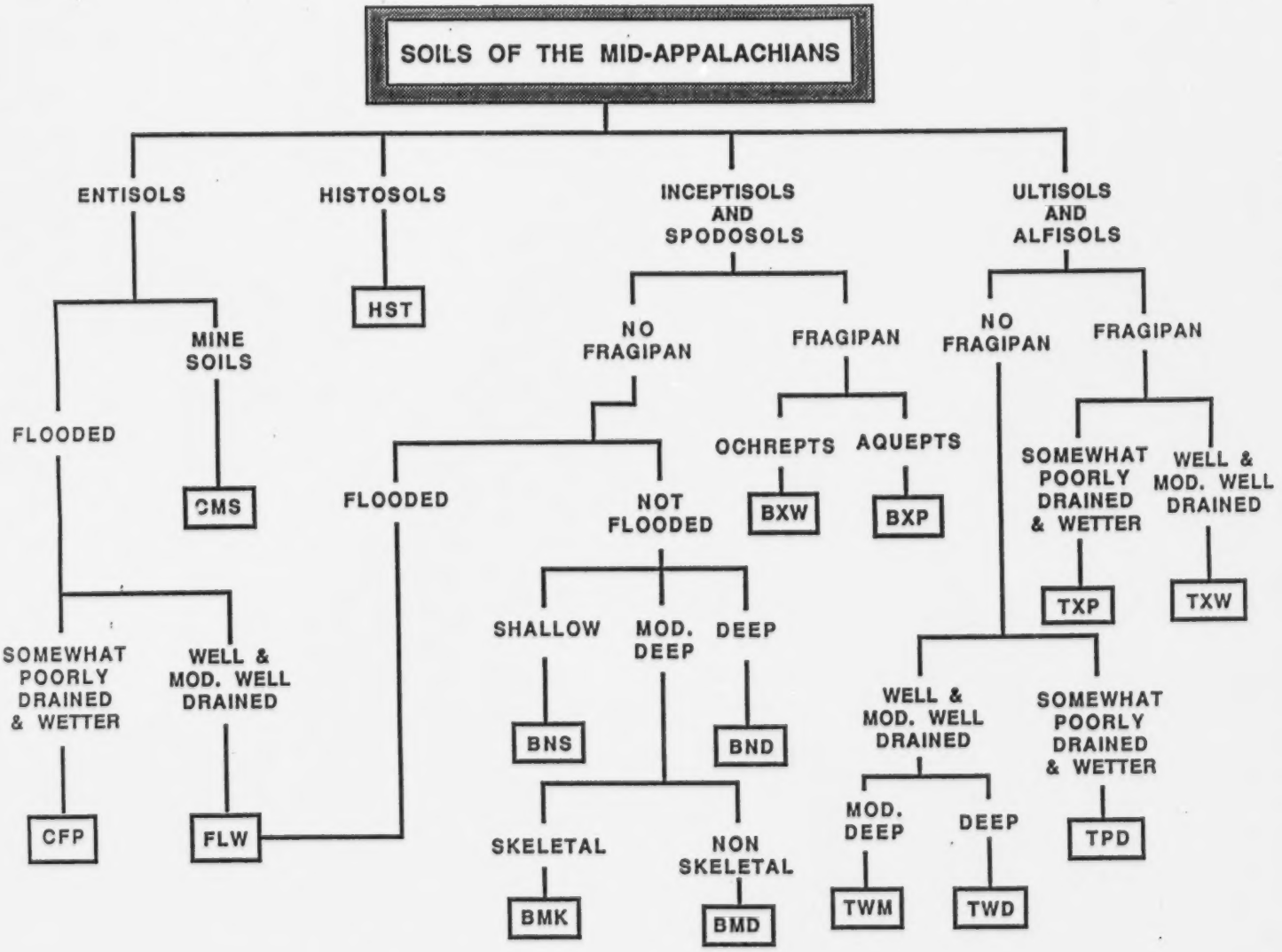

Figure 6. Final flowchart defining Direct/Delayed Response Project sampling classes for the Mid-Appalachian region. See Table 4 for explanation of symbols. See Appendix C for detailed descriptions of classes.

Table 5. Soils assigned to different sampling classes by workshop participants.

Soil	From	To	Reason
Fenwick	TWM	TPD	Change drainage from 4 to 3*
Zoar	TWD	TPD	Change drainage from 4 to 3
Albrights	TXP	TXW	Change drainage from 3 to 4
Buchanan	TXP	TXW	Change drainage from 3-4 to 4
Kedron	TXP	TXW	Change drainage from 3-4 to 5
Simoda	BXW	TXW	Would be argillic if not frigid
Udifluvents	CFP	CFW	Drainage is 4, not 2

* 2 = poorly drained
3 = somewhat poorly drained
4 = moderately well drained
5 = well drained

Table 6. Soil series in each sampling class. Soils mapped at the subgroup or great group level are shown in quotations.

BMD	Ashe, Lordstown, Muskingum, Steinsburg, Sylco
BMK	Berks, Calvin, Calvin variant, Cataska, Catoctin, Dekalb, Gauley, Lehew, Mandy, Oquaga, Wallen
BND	Brandywine, Hazleton, Leetonia, Muskingum variant, Northcove, Shelocta variant, Tunkhannock, Tusquitee, "Typic Dystrochrepts", Wyoming
BNS	Arnot, Cleveland, Klinesville, Ramsey, Sylvatus, Unicoi, Weikert
BXP	Chippewa, Morris, Norwich, Trussel, Volusia
BXW	Bath, Braceville, Lackawanna, Swartswood, "Typic Fragiochrepts", Wellsboro, Wurtsboro
CFP	Atkins, "Fluvaquents"
CMS	Cedarcreek, Kaymine
FLW	Barbour, Basher, Codurus, Craigsville, Philo, Pope, Potomac, Sensabaugh, "Udifluvents"
HST	Carlisle, "Lithic Medihemists", Palms
TPD	Armagh, Blairton, Cavode, Fenwick, Tygart, Zoar
TWD	Bedington, Clymer, Eubanks, Hartleton, Leck Kill, Lew, Meadowville, Minneville, Morrison, Meyersville, Rayne, Shelocta, Shouns, Thurmont, Upshur, Wharton
TWM	Cateache, Gilpin, Highfield, Lily
TXP	Andover, Brinkerton, Nolo
TXW	Albrights, Buchanan, Cookport, Ernest, Kedron, Laidig, Meckesville, Monongahela, Simoda

SECTION 4

OTHER DECISIONS AT THE WORKSHOP

Sampling classes were designed to attain adequate resolution of soil properties in the Mid-Appalachian region, while limiting the sampling effort to a practical number of pedons. Within the resources available, a maximum of 150 pedons could be described, sampled, and analyzed. Specific decisions and recommendations made at the workshop concerning the application of the sampling classes are documented in this section.

1. Parent Material/Blue Ridge Watersheds

The workshop participants considered branching on mineralogy of parent material. This was rejected because, except for two watersheds in the Piedmont (DDRP number 2B047066) and Blue Ridge Mountains (2B047089) of Virginia, all DDRP Mid-Appalachian watersheds are on sedimentary bedrock. It was decided to remove the two non-sedimentary watersheds from the general Mid-Appalachian scheme, and to develop a separate sampling strategy for them. The workshop participants recommended that four pedons be allocated to each of these watersheds.

A third watershed (2B047076) near these two is mainly on quartzite with some interbedded phyllite. It is transitional between the Mid-Appalachians and the Blue Ridge Mountains. After considerable discussion, it was left in the Mid-Appalachian scheme.

2. Mine Soils Sampling Class (CMS)

There are only 35 Ha (85 acres) of this class, in three watersheds. It was kept as a separate class because these soils are expected to be extremely different from all other soils in the region. It was suggested that one sample of this class should be taken from each of the three watersheds where it occurs.

3. Histosols (HST)

This class occurs on only 80 Ha (200 acres) in the region. Because of the organic parent material of these soils, they could not be grouped into any other sampling class. The workshop participants decided to keep this class, but recommended reducing the number of pedons allocated to it.

4. Skeletal Moderately Deep Typic Dystrochrepts (BMK)

This class occurs on approximately 8,900 Ha (22,000 acres), or almost 1/3 of the total acreage for the region. The workshop members discussed the possibility of splitting this class into smaller classes, but could not identify any meaningful soil characteristic to use. They decided to leave this class intact, and recommended increasing the number of pedons allocated to it. These pedons would be taken from the CMS and HST classes.

5. Non-Skeletal Deep Typic Dystrochrepts (BND)

This class occurs on approximately 5,300 Ha (13,000 acres). It was suggested that consideration be given to allocating extra pedons to this class.

6. Deposition Gradients and Allocation of Pedons

Most of the sampling classes are broadly distributed across the region. The major exceptions to this are those classes dominated by glacial soils (classes BXP and BXW); these soils are limited to the extreme northern part of the region. Thus, the properties (e.g., sulfate concentrations) of soils within individual classes might vary along the deposition gradient in the region. The workshop participants recognized this as a concern, but did not resolve the issue.

SECTION 5

POST-WORKSHOP ALLOCATION OF PEDONS FOR SAMPLING

The allocation of pedons to sampling classes and watersheds for sampling was done by DDRP statisticians and scientists after the workshop, who took into consideration the recommendations from the workshop (Section 4). Four pedons were reserved for each of the two Piedmont/Blue Ridge watersheds (i.e., total of eight pedons). One hundred and forty-two pedons were allocated to the 15 sampling classes on the remaining 34 watersheds. As in the SBRP, sampling sites for a particular sampling class were selected only in map units that had at least 20 percent of their area in that class. (This was an extension of the criterion used during mapping, that soils constituting at least 20 percent of a map unit were included in the map unit name.)

5.1 Allocation of pedons to watersheds

Table 7 gives the area of each sampling class for each of the 34 watersheds, tallying only map units eligible for sampling (i.e., 20 percent of area in the class). There were a total of 158 occurrences (i.e., non-zero entries in Table 7) of sampling classes in watersheds. Thus, it was possible to select almost all occurrences for sampling, and for several sampling classes this was done. Table 8 summarizes the number of pedons allocated to each sampling class, the number of occurrences, and the number of occurrences selected. The selection of occurrences was accomplished according to the following principles:

1. Pedons were allocated over sampling classes proportionally to frequency and to the area of occurrence, with a target of at least eight pedons per sampling class. (In comparison, eight pedons were sampled for most classes in the Northeast and SBRP.)

2. As suggested at the workshop, fewer pedons were allocated to classes CMS and HST. All occurrences were selected for at least one pedon.

3. Within the sampling class, pedons were allocated over watersheds proportionally to the area of the sampling class on the watershed.

4. All watersheds received at least two pedons.

5. If the sampling class occurred in watersheds in several topographic regions or in regions of suspected deposition differences, then the pedons were distributed over those regions.

6. Piedmont/Blue Ridge watersheds were allocated four pedons each.

The watersheds were divided into five geographic groups based on geologic, climatic, and deposition differences. Group 1 contained watersheds in the glaciated part of northeastern Pennsylvania (Glaciated Allegheny Plateau and Catskill Mountains MLRA) and the northernmost part of the Northern Appalachian Ridges and Valleys Major Land Resource Area (MLRA) (i.e., in subregion 1D of the National Stream Survey). Group 2 contained watersheds in the remainder of the Northern Appalachian Ridges and Valleys MLRA. Group 3 contained watersheds in the Northern and Southern Appalachian Ridges and Valleys MLRAs; one watershed was transitional to the Blue Ridge MLRA. Group 4 contained watersheds in the northern portion of the Eastern Allegheny Plateau and Mountains MLRA. Group 5 contained watersheds in the southern portion of the Eastern Allegheny Plateau and Mountains MLRA, and one watershed in the Southern Appalachian Ridges and Valleys MLRA. Figure 2 shows the watersheds by group.

Detailed descriptions of the selection process for each sampling class are given below. In these, "small" generally indicates occurrences of less than 4 Ha (10 acres). "Large" refers to the percent watershed area, not acreage of occurrences. The precise way in which these terms were applied should be clear from consulting Table 7. The geographic groups were used only for sampling classes for which it was not

Table 7. Area in hectares of sampling classes on DDRP Mid-Appalachian watersheds. This is based on dot-grid measurements by SCS, and only includes map units with at least 20% of the sampling class; i.e., inclusions that do not sum to 20% are excluded. Watershed areas thus are underestimated.

ID	BMD	BMK	BND	BNS	BXP	BXW	CFP	CMS	FLW	HST	TPD	TWD	TWM	TXP	TXW	TOTAL
1D029023	184	274	0	0	161	566	0	0	0	21	0	0	0	0	0	1206
1D029031	34	165	0	0	7	732	14	0	18	11	0	0	0	0	0	982
1D029042	106	770	0	15	127	424	0	0	0	0	0	0	0	0	0	1441
1D029043	71	67	81	5	225	1276	0	0	0	22	0	0	0	0	0	1746
1D036011	0	75	229	0	0	0	5	0	6	0	0	0	0	0	106	420
1D036017	0	245	399	0	0	0	22	0	27	0	0	0	0	6	360	1060
1D037005	0	14	156	0	0	0	0	0	0	18	0	0	14	30	630	862
2B036028	0	96	68	47	0	0	0	0	0	0	0	68	0	0	67	346
2B036046	0	124	81	0	0	0	21	0	22	0	0	202	0	2	433	885
2B036062	0	364	217	131	0	0	21	0	29	0	38	39	0	68	709	1616
2B041008	0	894	20	450	0	0	0	0	45	0	13	0	0	4	75	1501
2B041032	0	971	50	0	0	0	0	0	0	0	0	0	0	0	0	1021
2B047032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B047036	0	1599	87	403	0	0	0	0	135	0	0	0	0	0	9	2232
2B047066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B047076	0	227	0	0	0	0	0	0	11	0	0	0	0	0	19	256
2B047089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2C028069	0	0	0	0	0	0	0	0	0	0	0	87	51	21	246	406
2C028070	0	129	1006	0	0	0	0	0	0	0	0	0	0	9	246	1390
2C028075	0	70	465	0	0	0	0	0	0	0	0	0	0	0	322	857
2C029002	0	0	478	0	0	0	0	0	15	0	0	426	0	0	0	920
2C029016	0	18	248	0	0	0	0	0	0	0	0	0	0	24	176	467
2C029020	0	0	1287	0	0	0	6	8	2	0	0	0	0	47	223	1574
2C035027	0	53	136	0	0	0	0	0	0	0	66	314	175	68	626	1438
2C041002	0	3	26	0	0	0	0	0	0	0	0	58	0	8	16	112
2C041039	0	40	0	0	0	0	12	0	20	0	0	0	386	0	0	457
2C041040	0	0	0	0	0	0	2	0	3	0	0	0	145	0	0	149
2C041045	0	0	0	0	0	0	0	0	71	0	0	0	1344	0	182	1596
2C041051	0	56	44	0	74	0	0	0	0	0	0	0	27	0	243	443
2C046005	0	0	0	0	0	0	0	3	1	0	0	0	41	0	18	63
2C046033	0	3	0	0	0	0	0	0	4	0	6	141	183	0	0	336
2C046034	0	113	19	0	0	0	0	0	0	0	0	0	0	0	17	149
2C046041	0	0	0	0	0	0	0	0	0	0	9	0	103	0	47	159
2C046050	36	0	0	0	0	0	0	0	0	0	0	0	0	0	7	44
2C047007	0	179	0	35	0	0	0	0	20	0	0	0	26	0	24	283
2C047010	0	761	0	0	0	0	6	0	9	0	0	0	0	0	0	775
2C057004	205	0	0	0	0	0	0	23	0	0	0	0	0	0	43	271
TOTAL	637	7309	5098	1084	593	2997	108	34	435	71	132	1335	2494	288	4844	27462

Table 8. Allocation of pedons to sampling class occurrences.

Sampling Class	No. Pedons	No. Occurrences	No. Occurrences Selected
BMD	8	6	6
BMK	17	25	16
BND	14	19	14
BNS	8	7	6
BXP	8	5	5
BXW	8	4	4
CFP	8	9	8
CMS	4	3	3
FLW	13	17	13
HST	4	4	4
TPD	7	5	5
TWD	9	8	8
TWM	10	11	10
TXP	8	11	8
TXW	16	24	16

Table 9. List of watersheds by geographic group.

Group 1:	1D029023, 1D029031, 1D029042, 1D029043, 1D036011, 1D036017, 1D032005
Group 2:	2B036028, 2B036046, 2B036062, 2B041008
Group 3:	2B047032, 2B047036, 2B047076
Group 4:	2C028069, 2C028070, 2C028075, 2C029002, 2C029016, 2C029020, 2C035027, 2C041002
Group 5:	2C041039, 2C041040, 2C041045, 2C041051, 2C046005, 2C046033, 2C046034, 2C046041, 2C046050, 2C047007, 2C047010, 2C057004
Blue Ridge/Piedmont:	2B047066, 2B047089.

practical to sample all "large" occurrences (i.e., sampling classes BND, BMK, and TXW; see Figure 6 for definition of classes and Appendix C for characteristics of soils in these classes).

BND: BND occurred on 19 watersheds, with 4, 4, 2, 7, and 2 occurrences in geographic groups 1, 2, 3, 4, and 5, respectively.

Pedons were allocated over geographic groups as 3, 3, 2, 4, and 2, respectively, partly in consideration of several small occurrences. Watersheds were selected at random within geographic groups after elimination of small occurrences.

BMK: BMK occurred on 25 watersheds, with 7, 4, 3, 5, and 6 occurrences in geographic groups 1, 2, 3, 4, and 5, respectively.

Pedons were allocated over geographic groups as 4, 3, 3, 3, and 3, respectively, partly in consideration of several small occurrences. Watersheds were selected at random within group after elimination of small occurrences. One extra BMK pedon was allocated to watershed 2B047076 which is transitional to the Blue Ridge MLRA, so that this watershed could be treated similarly to the Blue Ridge watersheds, should laboratory analyses indicate that soils on this watershed are different from the Mid-Appalachian soils.

TXW: TXW occurred on 24 watersheds, with 3, 4, 2, 7, and 8 occurrences in geographic groups 1, 2, 3, 4, and 5, respectively. Both occurrences in Group 3 were small acreages, and represented small portions of the watersheds on which they occurred.

Pedons were allocated over geographic groups as 3, 3, 0, 5, and 5, respectively. Watersheds were selected at random within geographic groups.

FLW: FLW occurred on 17 watersheds. Of these, four occurrences were very small. These four were omitted and the other 13 were allocated one pedon each.

BMD: BMD occurred on six watersheds. The largest of these was allocated two pedons. Also, two pedons were allocated to 2C046050, because this watershed was almost 85 percent BMD, with the remaining area in sample class TXW. The other four watersheds received one pedon each.

BNS: BNS occurred on seven watersheds, with one very small occurrence and two very large ones. The small occurrence was dropped, and the large occurrences received two pedons each. All others received one pedon each.

BXP: BXP occurred on five watersheds, with two small and three large occurrences. The three large occurrences received two pedons each; the small occurrences received one pedon each.

BXW: BXW occurred on four watersheds, with all large areas of occurrence. Each watershed received two pedons.

CFP: CFP occurred on nine watersheds, with one small occurrence. The small was dropped; the others received one pedon each.

CMS: CMS occurred on three watersheds. The largest was allocated two pedons, the others one each for a total of four pedons.

HST: HST occurred on four watersheds, in each case a small percentage of the watershed. One pedon was allocated to each watershed.

TPD: TPD occurred on five watersheds, three small occurrences and two large. Two pedons were allocated to each of the large occurrences, and one pedon to each of the small occurrences.
TWD: TWD occurred on eight watersheds, one of which was very large. The largest watershed received two pedons; all others received one pedon.

TWM: TWM occurred on 11 watersheds, with one small occurrence. The smallest occurrence was dropped; all others received one pedon each.

TXP: TXP occurred on 11 watersheds with three small occurrences. The three smallest occurrences were dropped; all others received one pedon each.

5.2 Selection of potential sampling sites on watersheds

After a pedon was allocated to a watershed for a sampling class, a random procedure was used to specify potential sampling sites on the watershed. This procedure was similar to that used in the NE and SBRP (Lee et al., 1989a). Briefly, a dot grid was randomly placed over a soil map of the watershed. Five potential sampling sites were randomly selected from those dots that fell on map units eligible for sampling. Sampling crews proceeded to the first potential sampling site, and used a random procedure (Lee et al., 1989a; Kern et al, 1989) to search for a soil in the desired sampling class. If unsuccessful, they proceeded to the second potential sampling site, and so on until all potential sampling sites were exhausted. In the vast majority of cases, sampling crews were able to locate a suitable soil at the first potential sampling site.

A different approach was used for the two Piedmont/Blue Ridge watersheds. Sampling sites were selected to be representative of important soils on those specific watersheds. This was the same approach used for Special Interest Watersheds in the NE and SBRP (Lee et al., 1989a).

SECTION 6

DISCUSSION

The distinctions among the sampling classes defined for the Mid-Appalachian Region (Figure 6) reflect differences in soil properties expected to be important for the effect of acidic deposition on streams. Base cation supply, sulfate adsorption, water flow, and proximity to streams were important considerations. These are the same items that were considered in defining sampling classes for the NE (Lee et al., 1989b) and the SBRP (Lammers et al., in preparation). Thus, the sampling schemes for the three regions are consistent in rationale and purpose. The differences among them resulted from tailoring the schemes to fit the specific soils that occur on DDRP watersheds in each region.

The Entisols have the weakest development of the Mid-Appalachian soils; specifically, they do not have diagnostic B horizons. Frequently, they do not have B horizons of any kind. This has implications for aggregation of the soil data to the watershed level. Also, separating Entisols allows greater precision for soils that might have effects disproportionate to the area they occupy. Soils formed from mine spoils are likely to be very heterogeneous and, possibly, very acidic; DDRP will have at least some data for these soils for every watershed in which they occur. The flooded soils (Fluvents) are important because they occur adjacent to the streams. They are likely to differ from other soils because of the alluvial deposition/removal processes. Differences might include surface disturbances, irregular decreases in organic carbon with depth, and/or relatively high organic carbon at depth.

The organic parent material of the Histosols makes them distinctly different from the mineral soils in physical and chemical properties. Histosols also tend to be located near surface waters, and thus might exert an influence disproportionate to the area they occupy. Defining a Histosol sampling class (HST) ensured that, despite their small acreages, the DDRP had data on these potentially important soils.

The Ultisols and Alfisols both have an argillic horizon, but are distinguished by Ultisols having less than 35 percent base saturation. Because Alfisols in this region might not have much more than 35 percent base saturation, they were lumped with the Ultisols. The clay-enriched argillic horizon of these Orders is likely to have relatively low hydraulic conductivity, thus influencing the flow of water to streams. Also, these horizons are likely to differ from non-argillic horizons in properties correlated with clay content, such as cation exchange capacity (CEC) and sulfate adsorption.

The discussion of the importance of argillic horizons highlights the fact that the sampling classes (like all groupings of soils) are artificial boundaries placed on a continuum. Soils in one class might grade into another class. In addition to the argillic horizons, separations of depth to bedrock, skeletal versus non-skeletal, and drainage might intergrade.

The presence of a fragipan restricts water movement, thus limiting the amount of soil available for interaction with precipitation, and the time the precipitation is in contact with soil as it flows to the stream. Shallow soils are inherently limited in the amount of soil available to interact with precipitation. Skeletal soils have large percentages of rock fragments, and thus small percentages of fine soil. Compared to other soils, these soils might be limited in their ability to neutralize acidity from precipitation.

Soils that are "somewhat poorly drained and wetter" almost always have an aquic moisture regime. They have water at or near the surface for prolonged periods of time, and are likely to have an important role in the flow of water to the stream. Aquic soils are chemically different from other soils in that they tend to have reducing environments for prolonged periods. Sulfate entering these soils could be reduced to sulfide, thus reducing the potential for acidification of surface waters.

SECTION 7

SUMMARY

The DDRP was designed and implemented by the EPA to estimate the number of surface waters (lakes, streams) that might become acidic in three regions of the eastern U.S. due to current or altered levels of acidic deposition. The models and statistical analyses used by the DDRP (Church, 1989) required estimation of soil properties on 215 watersheds. This was accomplished by combining soil maps of individual watersheds with regional data on soil sampling classes. Because the database was not available (Lee et al., 1989a), soil survey activities were included within the DDRP.

Data analysis by the DDRP required estimates of the area of each sampling class for each DDRP watershed. These estimates were made from (1) the area of each map unit on the watershed and (2) the percent composition of sampling classes within map units on a regional basis. Fulfilling the objectives of the soil correlation segment of this workshop was a critical step toward ensuring the quality of the data used for these estimates.

The final definition of sampling classes has strong taxonomic tendencies; at the same time, it reflects those soil characteristics considered most important for the effects of acidic deposition on streams in the Mid-Appalachians. The sampling class scheme for the Mid-Appalachian region was consistent with those of the NE and SBRP in rationale and purpose. The differences among them resulted from tailoring the schemes to fit the specific soils that occur on DDRP watersheds in each region.

The resources available limited sampling and laboratory analysis to 150 pedons. The allocation of samples was not uniform across the 15 sampling classes. Geographic distribution, areal extent, and the importance for DDRP were considered in allocating samples to sampling classes and watersheds. An average of 10 pedons was sampled per sampling class. This was greater than the average for the other two regions (eight). The average number of pedons sampled per watershed was also greater in the Mid-Appalachian region (4) than in the NE (2) or the SBRP (3).

This workshop was the third time that DDRP scientists had been through the process of correlating soils, estimating map unit composition, and defining soil sampling classes. The usefulness of this approach had been demonstrated for the NE and SBRP. This workshop demonstrated improved efficiency in accomplishing the objectives. If needed, a similar approach could be implemented for any project that needed to attain adequate regional characterization of soils within practical constraints of resources.

SECTION 8

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APPENDIX A

PARTICIPANTS
DIRECT/DELAYED RESPONSE PROJECT
MID-APPALACHIAN SOIL CORRELATION
AND
SAMPLE CLASS SELECTION WORKSHOP

August 22-25, 1988

LaSells-Stewart Center
Oregon State University
Corvallis, OR

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APPENDIX B

DIRECT/DELAYED RESPONSE PROJECT MID-APPALACHIAN REGION SOIL SURVEYGassaway, WV 26624
SOIL MAP IDENTIFICATION/CORRELATION LEGEND 09/01/88

MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
0W		210	WATER	
1A		0	ALBRIGHTS CHANNERY SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
1B		0	ALBRIGHTS CHANNERY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
1C		0	ALBRIGHTS CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
1D		0	ALBRIGHTS CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
2A		0	ALLEGHENY SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
2B		0	ALLEGHENY SILT LOAM, 03-08% SLOPES	CARTO COMBINE W/18C, 4 ACRES
3A		0	ALVIRA SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
3B		0	ALVIRA SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
3C		0	ALVIRA SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
4A		94	ANDOVER CHANNERY LOAM, 00-03% SLOPES	
4B		87	ANDOVER CHANNERY LOAM, 03-08% SLOPES	
4C		0	ANDOVER CHANNERY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
4D		0	ANDOVER CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
5A		0	ARMAGH SILT LOAM, 00-03% SLOPES	COMBINE W/ 5B, 7 ACRES
5B	5A	33	ARMAGH SILT LOAM, 03-08% SLOPES	
6B		42	ARNOT CHANNERY LOAM, 03-08% SLOPES	OQUAGA ADDED TO NAME
6C		0	ARNOT CHANNERY LOAM, 08-15% SLOPES	COMBINE W/ 6B, 10 ACRES
6D		19	ARNOT CHANNERY LOAM, 15-25% SLOPES	OQUAGA ADDED TO NAME
7A		105	ATKINS SILT LOAM, 00-03% SLOPES	
8A		0	BARBOUR GRAVELLY LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
9A		37	BASHER GRAVELLY LOAM, 00-03% SLOPES	
10B		529	BATH CHANNERY SILT LOAM, 03-08% SLOPES	
10C		425	BATH CHANNERY SILT LOAM, 08-15% SLOPES	
10D		856	BATH CHANNERY SILT LOAM, 15-25% SLOPES	
11B		198	BEDINGTON CHANNERY SILT LOAM, 03-08% SLOPES	
11C		20	BEDINGTON CHANNERY SILT LOAM, 08-15% SLOPES	
11D		0	BEDINGTON CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
12F		0	BELMONT CHANNERY SILT LOAM, 35-70% SLOPES	DELETE, NOT MAPPED
13B		195	BERKS CHANNERY SILT LOAM, 03-08% SLOPES	
13C		674	BERKS CHANNERY SILT LOAM, 08-15% SLOPES	
13D		141	BERKS CHANNERY SILT LOAM, 15-25% SLOPES	
13E		0	BERKS CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
13F		572	BERKS CHANNERY SILT LOAM, 35-70% SLOPES	
14B		95	BERKS-WEIKERT CHANNERY SILT LOAMS, 03-08% SLOPES	
14C		739	BERKS-WEIKERT CHANNERY SILT LOAMS, 08-15% SLOPES	
14D		814	BERKS-WEIKERT CHANNERY SILT LOAMS, 15-25% SLOPES	
14E		575	BERKS-WEIKERT CHANNERY SILT LOAMS, 25-35% SLOPES	
14F		4744	BERKS-WEIKERT CHANNERY SILT LOAMS, 35-70% SLOPES	
15B		0	BLAIRTON CHANNERY SILT LOAM, 03-08% SLOPES	COMBINE W/ 15C, 8 ACRES
15C	15B	26	BLAIRTON CHANNERY SILT LOAM, 08-15% SLOPES	
15D		0	BLAIRTON CHANNERY SILT LOAM, 15-25% SLOPES	CHANGE TO 215D, 19 ACRES
16B		0	BRANDYWINE LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
16C		0	BRANDYWINE LOAM, 08-15% SLOPES	DELETE, NOT MAPPED

SOIL MAP IDENTIFICATION/CORRELATION LEGEND 09/01/88

MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
16D		0	BRANDYWINE LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
16E		0	BRANDYWINE LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
16F		0	BRANDYWINE LOAM, 35-45% SLOPES	DELETE, NOT MAPPED
17A		341	BRINKERTON SILT LOAM, 00-03% SLOPES	
17B		260	BRINKERTON SILT LOAM, 03-08% SLOPES	
18B	66B	1405	BUCHANAN CHANNERY SILT LOAM, 03-08% SLOPES	
18C	2B, 133C	965	BUCHANAN CHANNERY SILT LOAM, 08-15% SLOPES	
18D		17	BUCHANAN CHANNERY SILT LOAM, 15-25% SLOPES	
18E		0	BUCHANAN CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
19B		349	CALVIN CHANNERY SILT LOAM, 03-08% SLOPES	
19C		316	CALVIN CHANNERY SILT LOAM, 08-15% SLOPES	
19D		351	CALVIN CHANNERY SILT LOAM, 15-25% SLOPES	
19E		390	CALVIN CHANNERY SILT LOAM, 25-35% SLOPES	
19F		86	CALVIN CHANNERY SILT LOAM, 35-65% SLOPES	
20B		0	CALVIN-DEKALB-HAZLETON COMPLEX, 03-08% SLOPES	DELETE, NOT MAPPED
20C		0	CALVIN-DEKALB-HAZLETON COMPLEX, 08-15% SLOPES	COMBINE W/ 120D, 13 ACRES
20D	20C	0	CALVIN-DEKALB-HAZLETON COMPLEX, 15-25% SLOPES	DROP HAZLETON,CHANGE TO 120D
20E		0	CALVIN-DEKALB-HAZLETON COMPLEX, 25-35% SLOPES	DELETE, NOT MAPPED
20F		616	CALVIN-DEKALB-HAZLETON COMPLEX, 35-65% SLOPES	
21B		0	CALVIN-KLINESVILLE CHANNERY SILT LOAMS, 03-08% SLOPES	DELETE, NOT MAPPED
21C		0	CALVIN-KLINESVILLE CHANNERY SILT LOAMS, 08-15% SLOPES	DELETE, NOT MAPPED
21D		0	CALVIN-KLINESVILLE CHANNERY SILT LOAMS, 15-25% SLOPES	DELETE, NOT MAPPED
21E		0	CALVIN-KLINESVILLE CHANNERY SILT LOAMS, 25-35% SLOPES	DELETE, NOT MAPPED
21F		0	CALVIN-KLINESVILLE CHANNERY SILT LOAMS, 35-65% SLOPES	DELETE, NOT MAPPED
22A		55	CARLISLE MUCK, 00-03% SLOPES	
23E		0	CATEACHE CHANNERY SILT LOAM, 25-35% SLOPES	COMBINE W/ 23F, 14 ACRES
23F	23E	69	CATEACHE CHANNERY SILT LOAM, 35-65% SLOPES	
24C		195	CATASKA-HARTLETON COMPLEX, 08-15% SLOPES	DROP HARTLETON FROM NAME
24D		175	CATASKA-HARTLETON CHANNERY LOAMS, 15-25% SLOPES	DROP HARTLETON FROM NAME
24E		0	CATASKA-HARTLETON CHANNERY LOAMS, 25-35% SLOPES	DELETE, NOT MAPPED
24F		1089	CATASKA-HARTLETON CHANNERY LOAMS, 35-65% SLOPES	DROP HARTLETON FROM NAME
25A		0	CAVODE SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
25B		171	CAVODE SILT LOAM, 03-08% SLOPES	ADD -ERNEST-WHARTON TO NAME
25C		0	CAVODE SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
25D		0	CAVODE SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
26A		0	CHENANGO GRAVELLY LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
26B		0	CHENANGO GRAVELLY LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
26C		0	CHENANGO GRAVELLY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
26D		0	CHENANGO GRAVELLY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
26E		0	CHENANGO GRAVELLY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
27A		36	CHEWACLA SILT LOAM, 00-03% SLOPES	CHANGED TO CODORUS LOAM
28A		155	CHIPPEWA CHANNERY SILT LOAM, 00-03% SLOPES	
28B		97	CHIPPEWA CHANNERY SILT LOAM, 03-08% SLOPES	
29B		367	CLYMER CHANNERY LOAM, 03-08% SLOPES	
29C		99	CLYMER CHANNERY LOAM, 08-15% SLOPES	
29D		0	CLYMER CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED

SOIL MAP IDENTIFICATION/CORRELATION LEGEND 09/01/88

MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
29E		0	CLYMER CHANNERY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
29F		0	CLYMER CHANNERY LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
30B		1140	COOKPORT VARIANT , 03-08% SLOPES	DROP VAR,CBM 12 AC IN WV W/38B
30C		0	COOKPORT CHANNERY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
30D		0	COOKPORT CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
31A	76A, 102A, 136C	568	CRAIGSVILLE GRAVELLY SANDY LOAM, 00-03% SLOPES	CHANGE TO GRV, 00-05% SLOPES
32B	32C	56	DEKALB CHANNERY LOAM, 03-08% SLOPES	
32C		0	DEKALB CHANNERY LOAM, 08-15% SLOPES	COMBINE W/ 32B, 8 ACRES
32D		44	DEKALB CHANNERY LOAM, 15-25% SLOPES	
32E		23	DEKALB CHANNERY LOAM, 25-35% SLOPES	
32F		0	DEKALB CHANNERY LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
33B		60	DEKALB CHANNERY LOAM, 03-08% SLOPES, STONY	
33C		0	DEKALB CHANNERY LOAM, 08-15% SLOPES, STONY	DELETE, NOT MAPPED
33D		0	DEKALB CHANNERY LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
33E		0	DEKALB CHANNERY LOAM, 25-35% SLOPES, STONY	COMBINE W/ 46E, 9 ACRES
33F		0	DEKALB CHANNERY LOAM, 35-65% SLOPES, STONY	DELETE, NOT MAPPED
34F		0	DRALL CHANNERY LOAM, 35-70% SLOPES, STONY	DELETE, NOT MAPPED
35B		0	ELLIBER VERY CHANNERY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
35C		0	ELLIBER VERY CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
35D		0	ELLIBER VERY CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
35E		0	ELLIBER VERY CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
36B		1450	ERNEST SILT LOAM, 03-08% SLOPES	
36C	134B	636	ERNEST SILT LOAM, 08-15% SLOPES	
36D		74	ERNEST SILT LOAM, 15-25% SLOPES	
36E		0	ERNEST SILT LOAM, 25-35% SLOPES	COMBINE W/ 135E, 17 ACRES
37B		23	EUBANKS-LLOYD LOAMS, 03-08% SLOPES	DROP LLOYD FROM NAME
37C		63	EUBANKS-LLOYD LOAMS, 08-15% SLOPES	DROP LLOYD FROM NAME
37D		38	EUBANKS-LLOYD LOAMS, 15-25% SLOPES	DROP LLOYD FROM NAME
37E		55	EUBANKS-LLOYD LOAMS, 25-35% SLOPES	DROP LLOYD FROM NAME
37F		0	EUBANKS-LLOYD LOAMS, 35-45% SLOPES	DELETE, NOT MAPPED
38B	(30B)	31	FENWICK SILT LOAM, 03-08% SLOPES	INC 12 ACRES OF 30B IN WV
39A		0	FLUVAQUENTS , 00-03% SLOPES,	DELETE, NOT MAPPED
40B		0	GAULEY CHANNERY SANDY LOAM, 03-08% SLOPES, STONY	DELETE, NOT MAPPED
40C		26	GAULEY CHANNERY SANDY LOAM, 08-15% SLOPES, STONY	
40D		0	GAULEY CHANNERY SANDY LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
40E		0	GAULEY CHANNERY SANDY LOAM, 25-35% SLOPES, STONY	DELETE, NOT MAPPED
40F		0	GAULEY CHANNERY SANDY LOAM, 35-80% SLOPES, STONY	DELETE, NOT MAPPED
41B		128	GILPIN SILT LOAM, 03-08% SLOPES	CHANGE TO CN
41C		416	GILPIN SILT LOAM, 08-15% SLOPES	CHANGE TO CN
41D		1136	GILPIN SILT LOAM, 15-25% SLOPES	CHANGE TO CN
41E		438	GILPIN SILT LOAM, 25-35% SLOPES	CHANGE TO CN
41F		4192	GILPIN SILT LOAM, 35-70% SLOPES	CHANGE TO CN
42B		0	GILPIN-LILY COMPLEX, 03-08% SLOPES	COMBINE W/ 42C, 6 ACRES
42C	42B	24	GILPIN-LILY COMPLEX, 08-15% SLOPES	
42D		0	GILPIN-LILY COMPLEX, 15-25% SLOPES	CHANGE TO 242D, 21 ACRES
42E		0	GILPIN-LILY COMPLEX, 25-35% SLOPES	DELETE, NOT MAPPED

SOIL MAP IDENTIFICATION/CORRELATION LEGEND 09/01/88

MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
43B		0	GUERNSEY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
43C		0	GUERNSEY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
44B		361	HARTLETON CHANNERY LOAM, 03-08% SLOPES	
44C		0	HARTLETON CHANNERY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
44D		42	HARTLETON CHANNERY LOAM, 15-25% SLOPES	
44E		0	HARTLETON CHANNERY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
44F		0	HARTLETON CHANNERY LOAM, 35-60% SLOPES	DELETE, NOT MAPPED
45B		671	HAZLETON CHANNERY LOAM, 03-08% SLOPES	
45C		352	HAZLETON CHANNERY LOAM, 08-15% SLOPES	
45D		126	HAZLETON CHANNERY LOAM, 15-25% SLOPES	
45E		68	HAZLETON CHANNERY LOAM, 25-35% SLOPES	
45F		443	HAZLETON CHANNERY LOAM, 35-65% SLOPES	
46B		4142	HAZLETON CHANNERY LOAM, 03-08% SLOPES, STONY	
46C		1981	HAZLETON CHANNERY LOAM, 08-15% SLOPES, STONY	
46D		1899	HAZLETON CHANNERY LOAM, 15-25% SLOPES, STONY	
46E	33E	2486	HAZLETON CHANNERY LOAM, 25-35% SLOPES, STONY	
46F		3065	HAZLETON CHANNERY LOAM, 35-65% SLOPES, STONY	
47B		435	HAZLETON-DEKALB CHANNERY LOAMS, 03-08% SLOPES	
47C		0	HAZLETON-DEKALB CHANNERY LOAMS, 08-15% SLOPES	DELETE, NOT MAPPED
47D		0	HAZLETON-DEKALB CHANNERY LOAMS, 15-25% SLOPES	DELETE, NOT MAPPED
47E		0	HAZLETON-DEKALB CHANNERY LOAMS, 25-35% SLOPES	DELETE, NOT MAPPED
47F		0	HAZLETON-DEKALB CHANNERY LOAMS, 35-65% SLOPES	DELETE, NOT MAPPED
48A		0	HOLLY SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
49B		312	KEDRON SILT LOAM, 03-08% SLOPES	
49C		0	KEDRON SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
49D		0	KEDRON SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
50B		0	KLINESVILLE CHANNERY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
50C		0	KLINESVILLE CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
50D		0	KLINESVILLE CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
50E		0	KLINESVILLE CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
50F		0	KLINESVILLE CHANNERY SILT LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
51B		317	LACKAWANNA CHANNERY LOAM, 03-08% SLOPES	
51C		520	LACKAWANNA CHANNERY LOAM, 08-15% SLOPES	
51D		653	LACKAWANNA CHANNERY LOAM, 15-25% SLOPES	
51E		182	LACKAWANNA CHANNERY LOAM, 25-35% SLOPES	
51F		236	LACKAWANNA CHANNERY LOAM, 35-65% SLOPES	ADDED TO LEGEND
52B		2064	LAIDIG CHANNERY LOAM, 03-08% SLOPES	
52C		395	LAIDIG CHANNERY LOAM, 08-15% SLOPES	
52D		35	LAIDIG CHANNERY LOAM, 15-25% SLOPES	
52E		0	LAIDIG CHANNERY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
53B		73	LECK KILL CHANNERY SILT LOAM, 03-08% SLOPES	
53C		73	LECK KILL CHANNERY SILT LOAM, 08-15% SLOPES	
53D		0	LECK KILL CHANNERY SILT LOAM, 15-25% SLOPES	CHANGE TO 253D, 162 ACRES
53E		0	LECK KILL CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
53F		0	LECK KILL CHANNERY SILT LOAM, 35-70% SLOPES	CHANGE TO 253F, 1232 ACRES
54B		0	LEETONIA SANDY LOAM, 03-08% SLOPES	DELETE, NOT MAPPED

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MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
54C		0	LEETONIA SANDY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
55B		0	LEHEW CHANNERY LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
55C		0	LEHEW CHANNERY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
55D		0	LEHEW CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
55E		0	LEHEW CHANNERY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
55F		0	LEHEW CHANNERY LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
56C		26	LEW CHANNERY SILT LOAM, 08-15% SLOPES	ADD STONY PHASE
56D		0	LEW CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
57A		0	LICKDALE SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
58B		95	LILY LOAM, 03-08% SLOPES	
58C	58D	170	LILY LOAM, 08-15% SLOPES	
58D		0	LILY LOAM, 15-25% SLOPES	COMBINE W/ 58C, 9 ACRES
59A		0	LINDEN LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
60B		107	LORDSTOWN CHANNERY SILT LOAM, 03-08% SLOPES	
60C		0	LORDSTOWN CHANNERY SILT LOAM, 08-15% SLOPES	COMBINE W/ 60D, 10 ACRES
60D	60C	55	LORDSTOWN CHANNERY SILT LOAM, 15-25% SLOPES	
60E		0	LORDSTOWN CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
60F		0	LORDSTOWN CHANNERY SILT LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
61D		0	LOUISBURG SANDY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
62B		0	MANDY CHANNERY SANDY LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
62C		264	MANDY CHANNERY SANDY LOAM, 08-15% SLOPES	CHANGE TO SILT LOAM
62D		678	MANDY CHANNERY SANDY LOAM, 15-25% SLOPES	CHANGE TO SILT LOAM
62E	101D	1002	MANDY CHANNERY SANDY LOAM, 25-35% SLOPES	CHANGE TO SILT LOAM
62F		1945	MANDY CHANNERY SANDY LOAM, 35-65% SLOPES	CHANGE TO SILT LOAM
63B		0	MARDIN CHANNERY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
63C		0	MARDIN CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
63D		0	MARDIN CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
64B		0	MEADOWVILLE LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
65B		383	MECKESVILLE CHANNERY LOAM, 03-08% SLOPES	
65C		712	MECKESVILLE CHANNERY LOAM, 08-15% SLOPES	
65D		374	MECKESVILLE CHANNERY LOAM, 15-25% SLOPES	
66B		0	MONONGAHELA SILT LOAM, 03-08% SLOPES	COMBINED W/ 18B, 6 ACRES
67B	72B	634	MORRIS CHANNERY LOAM, 03-08% SLOPES	
67C		0	MORRIS CHANNERY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
68B		55	MORRISON CHANNERY SANDY LOAM, 03-08% SLOPES	
68C		65	MORRISON CHANNERY SANDY LOAM, 08-15% SLOPES	
68D		78	MORRISON CHANNERY SANDY LOAM, 15-25% SLOPES	
69D		0	MURRILL VARIANT CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
70B		74	MYERSVILLE-CATOCTIN CHANNERY SILT LOAMS, 03-08% SLOPES	DROP MYERSVILLE, ADD ST PHASE
70C		164	MYERSVILLE-CATOCTIN CHANNERY SILT LOAMS, 08-15% SLOPES	DROP MYERSVILLE, ADD ST PHASE
70D		485	MYERSVILLE-CATOCTIN CHANNERY SILT LOAMS, 15-25% SLOPES	DROP MYERSVILLE, ADD ST PHASE
70E		0	MYERSVILLE-CATOCTIN CHANNERY SILT LOAMS, 25-35% SLOPES	DELETE, NOT MAPPED
70F		0	MYERSVILLE-CATOCTIN CHANNERY SILT LOAMS, 35-65% SLOPES	DELETE, NOT MAPPED
71A		29	NOLO SILT LOAM, 00-03% SLOPES	
71B		0	NOLO SILT LOAM, 03-08% SLOPES	CHANGE TO 271B, 45 ACRES
72A		199	NORWICH CHANNERY LOAM, 00-03% SLOPES	
72B		0	NORWICH CHANNERY LOAM, 03-08% SLOPES	COMBINED W/ 67B, 17 ACRES

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MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
73B		763	OQUAGA CHANNERY LOAM, 03-08% SLOPES	
73C		729	OQUAGA CHANNERY LOAM, 08-15% SLOPES	
73D		673	OQUAGA CHANNERY LOAM, 15-25% SLOPES	
73E		105	OQUAGA CHANNERY LOAM, 25-35% SLOPES	
73F		0	OQUAGA CHANNERY LOAM, 35-65% SLOPES	CHANGE TO 273F, 2060 ACRES
74A		130	PALMS MUCK, 00-03% SLOPES	ADD CARLISLE TO NAME
75A		237	PHILO SILT LOAM, 00-03% SLOPES	
76A		0	POPE LOAM, 00-03% SLOPES	COMBINE W/ 31A, 9 ACRES
77A		0	POPE-ATKINS COMPLEX, 00-03% SLOPES	DELETE, NOT MAPPED
78A		26	POTOMAC COBBLY FINE SANDY LOAM, 00-03% SLOPES	CHANGE TO CBV AND 00-05% SLPS
79A		0	PURDY SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
80A		0	RAYNE SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
80B		0	RAYNE SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
80C		0	RAYNE SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
80D		0	RAYNE SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
81Z		183	RUBBLE LAND	
82A		0	SHELOCTA SILT LOAM, 00-03% SLOPES	DELETE, NOT MAPPED
82B		0	SHELOCTA SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
83D		0	SHOUNS CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
83E		0	SHOUNS CHANNERY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
84B		0	SIMODA CHANNERY LOAM, 03-08% SLOPES	CHANGE TO 184B, 103 ACRES
84C		46	SIMODA CHANNERY LOAM, 08-15% SLOPES	CHANGE TO SIL
85B		0	STARR SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
86B		0	SWARTSWOOD CHANNERY LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
86C		108	SWARTSWOOD CHANNERY LOAM, 08-15% SLOPES	
86D		0	SWARTSWOOD CHANNERY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
87B		145	TRUSSEL CHANNERY SILT LOAM, 03-08% SLOPES	ADD SIMODA TO NAME
87C		0	TRUSSEL CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
87D		0	TRUSSEL CHANNERY SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
87E		0	TRUSSEL CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
88B		0	TUNKHANNOCK GRAVELLY LOAM, 03-08% SLOPES	COMBINE W/ 98B, 8 ACRES
88C		0	TUNKHANNOCK GRAVELLY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
88D		0	TUNKHANNOCK GRAVELLY LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
89C		0	TUSQUITEE LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
89D		0	TUSQUITEE LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
90A		73	TYGART SILT LOAM, 00-03% SLOPES	
91A		0	TYPIC UDORTHENTS , 00-03% SLOPES	DELETE, NOT MAPPED
92B		95	VOLUSIA CHANNERY SILT LOAM, 03-08% SLOPES	
92C		0	VOLUSIA CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
93B		0	WEIKERT CHANNERY SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
93C		0	WEIKERT CHANNERY SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
93D		77	WEIKERT CHANNERY SILT LOAM, 15-25% SLOPES	
93E		0	WEIKERT CHANNERY SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
93F		0	WEIKERT CHANNERY SILT LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
94B		1212	WELLSBORO CHANNERY LOAM, 03-08% SLOPES	ADD LACKAWANNA TO NAME
94C		460	WELLSBORO CHANNERY LOAM, 08-15% SLOPES	ADD LACKAWANNA TO NAME
94D		79	WELLSBORO CHANNERY LOAM, 15-25% SLOPES	ADD LACKAWANNA TO NAME

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95B		0	WESTMORELAND SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
95C		0	WESTMORELAND SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
95D		0	WESTMORELAND SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
95E		0	WESTMORELAND SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
96B		238	WHARTON SILT LOAM, 03-08% SLOPES	
96C		85	WHARTON SILT LOAM, 08-15% SLOPES	
96D		0	WHARTON SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
97B		1368	WURTSBORO CHANNERY LOAM, 03-08% SLOPES	
97C		292	WURTSBORO CHANNERY LOAM, 08-15% SLOPES	
98B	88B	180	WYOMING GRAVELLY SANDY LOAM, 03-08% SLOPES	
98C		0	WYOMING GRAVELLY SANDY LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
98D		27	WYOMING GRAVELLY SANDY LOAM, 15-25% SLOPES	
98E		0	WYOMING GRAVELLY SANDY LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
98F		0	WYOMING GRAVELLY SANDY LOAM, 35-65% SLOPES	DELETE, NOT MAPPED
99B		0	BERKS CHANNERY SILT LOAM, 02-08% SLOPES, STONY	DELETE, NOT MAPPED
99C		0	BERKS CHANNERY SILT LOAM, 08-15% SLOPES, STONY	DELETE, NOT MAPPED
99D		0	BERKS CHANNERY SILT LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
99E		0	BERKS CHANNERY SILT LOAM, 25-35% SLOPES, STONY	DELETE, NOT MAPPED
99F		0	BERKS CHANNERY SILT LOAM, 35-70% SLOPES, STONY	DELETE, NOT MAPPED
100B		0	MANDY CHANNERY SILT LOAM, 03-08% SLOPES, STONY	DELETE, NOT MAPPED
100C		0	MANDY CHANNERY SILT LOAM, 08-15% SLOPES, STONY	DELETE, NOT MAPPED
100D		0	MANDY CHANNERY SILT LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
100E		0	MANDY CHANNERY SILT LOAM, 25-35% SLOPES, STONY	DELETE, NOT MAPPED
100F		235	MANDY CHANNERY SILT LOAM, 35-65% SLOPES, STONY	
101D		0	TYPIC FRAGIOCHREPTS , 15-25% SLOPES,	CARTO COMBINE W/ 62E, 11 ACRES
102A		0	CRAIGSVILLE LOAM, 00-03% SLOPES	COMBINE W/ 31A, 11 ACRES
103F		1082	CALVIN-LEHEW-DEKALB COMPLEX, 35-70% SLOPES, STONY	
104C		132	CALVIN-LEHEW-DEKALB COMPLEX, 08-15% SLOPES	
104D		260	CALVIN-LEHEW-DEKALB COMPLEX, 15-25% SLOPES	
104E		263	CALVIN-LEHEW-DEKALB COMPLEX, 25-35% SLOPES	
104F		730	CALVIN-LEHEW-DEKALB COMPLEX, 35-70% SLOPES	
105D		259	TYPIC DYSTROCHREPTS , 15-25% SLOPES, STONY	CHANGE NAME TO NORTHCOVE CNL
105F		101	TYPIC DYSTROCHREPTS , 35-65% SLOPES, STONY	CHANGE NAME TO NORTHCOVE CNL
106D		0	WALLEN VERY CHANNERY SANDY LOAM, 15-25% SLOPES	COMBINE W/ 106E, 8 ACRES
106E	106D	40	WALLEN VERY CHANNERY SANDY LOAM, 25-35% SLOPES	
107D		0	WALLEN VERY CHANNERY SANDY LOAM, 15-25% SLOPES, RUBBLY	COMBINE W/ 107F, 11 ACRES
107F	107D	496	WALLEN VERY CHANNERY SANDY LOAM, 35-70% SLOPES, RUBBLY	
108F		157	WALLEN-RUBBLE LAND COMPLEX, 35-70% SLOPES	
109A		35	UDIFLUVENTS-FLUVAQUENTS COMPLEX, 00-05% SLOPES, FRIGID	
110A		81	CRAIGSVILLE-FLUVAQUENTS COMPLEX, 00-05% SLOPES	
111A		365	UDIFLUVENTS-FLUVAQUENTS COMPLEX, 00-05% SLOPES, MESIC	
112C		554	SIMODA CHANNERY SILT LOAM, 08-15% SLOPES, BOULDERY	
113C		55	TRUSSEL CHANNERY SILT LOAM, 08-15% SLOPES, BOULDERY	
114F		196	MANDY-ROCK OUTCROP COMPLEX, 35-70% SLOPES, BOULDERY	DELETE BOULDERY PHASE
116D		20	ASHE LOAM, 15-25% SLOPES	
116F		118	ASHE LOAM, 35-55% SLOPES	
120D	20C, 20D	68	CALVIN-DEKALB COMPLEX, 15-25% SLOPES	DEKALB ADDED TO NAME, WAS 20D

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MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
126B		586	BUCHANAN CHANNERY LOAM, 03-08% SLOPES, STONY	
126C		826	BUCHANAN CHANNERY LOAM, 08-15% SLOPES, STONY	
126D		109	BUCHANAN CHANNERY LOAM, 15-25% SLOPES, STONY	
126E		242	BUCHANAN CHANNERY LOAM, 25-35% SLOPES, STONY	
127B		0	MUSKINGUM SILT LOAM, 03-08% SLOPES	DELETE, NOT MAPPED
127C		313	MUSKINGUM SILT LOAM, 08-15% SLOPES	
127D		141	MUSKINGUM SILT LOAM, 15-25% SLOPES	
127E		0	MUSKINGUM SILT LOAM, 25-35% SLOPES	DELETE, NOT MAPPED
127F		255	MUSKINGUM SILT LOAM, 35-65% SLOPES	
128F		57	KAYMINE VERY CHANNERY SILT LOAM, 03-70% SLOPES	
130B		0	GILPIN SILT LOAM, 03-08% SLOPES, STONY	DELETE, NOT MAPPED
130C		0	GILPIN SILT LOAM, 08-15% SLOPES, STONY	DELETE, NOT MAPPED
130D		0	GILPIN SILT LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
130E		0	GILPIN SILT LOAM, 25-35% SLOPES, STONY	DELETE, NOT MAPPED
130F		476	GILPIN SILT LOAM, 35-70% SLOPES, STONY	ADD CN
131B		17	ZOAR SILT LOAM, 03-08% SLOPES	
131C		0	ZOAR SILT LOAM, 08-15% SLOPES	DELETE, NOT MAPPED
131D		0	ZOAR SILT LOAM, 15-25% SLOPES	DELETE, NOT MAPPED
132B		0	SHELOCTA SILT LOAM, 03-08% SLOPES, STONY	DELETE, NOT MAPPED
132C		81	SHELOCTA SILT LOAM, 08-15% SLOPES, STONY	
132D		0	SHELOCTA SILT LOAM, 15-25% SLOPES, STONY	DELETE, NOT MAPPED
132E		328	SHELOCTA SILT LOAM, 25-35% SLOPES, STONY	
133C		0	BUCHANAN CHANNERY LOAM, 08-15% SLOPES	COMBINE W/ 18C, SAME EXCPT TEX
134B		0	ALLEGHENY LOAM, 03-08% SLOPES	CARTO COMBINE W/ 36C, 2 ACRES
135E	36E	516	ERNEST CHANNERY SILT LOAM, 25-35% SLOPES	ADD LAIDIG TO NAME
136C		0	SENSABAUGH GRAVELLY SILT LOAM, 08-15% SLOPES, RARELY FLOODED	COMBINE W/ 31A, 11 ACRES
137E		653	LEW CHANNERY SILT LOAM, 25-35% SLOPES, RUBBLY	
138F		1373	MYERSVILLE CHANNERY SILT LOAM, 35-70% SLOPES, STONY	ADD CATOCTIN TO NAME
139D		29	CEDARCREEK CHANNERY LOAM, 15-25% SLOPES	
151B		125	LORDSTOWN CHANNERY LOAM, 03-08% SLOPES, STONY	
151C		104	LORDSTOWN CHANNERY LOAM, 08-15% SLOPES, STONY	
151D		0	LORDSTOWN CHANNERY LOAM, 15-25% SLOPES, STONY	CHANGE TO 251D, 98 ACRES
152C		39	MECKESVILLE CHANNERY LOAM, 08-15% SLOPES, STONY	
152D		310	MECKESVILLE CHANNERY LOAM, 15-25% SLOPES, STONY	
152E		552	MECKESVILLE CHANNERY LOAM, 25-60% SLOPES, STONY	
161B		400	GILPIN-RAYNE CHANNERY SILT LOAMS, 03-08% SLOPES	
161C		611	GILPIN-RAYNE CHANNERY SILT LOAMS, 08-15% SLOPES	
161D		294	GILPIN-RAYNE CHANNERY SILT LOAMS, 15-25% SLOPES	
171B		77	HARTLETON CHANNERY LOAM, 03-08% SLOPES, STONY	
171C		131	HARTLETON CHANNERY LOAM, 08-15% SLOPES, STONY	
171D		96	HARTLETON CHANNERY LOAM, 15-25% SLOPES, STONY	
172B		65	LAIDIG CHANNERY LOAM, 03-08% SLOPES, STONY	
172C		77	LAIDIG CHANNERY LOAM, 08-15% SLOPES, STONY	
181F		252	LORDSTOWN , 35-65% SLOPES	ADDED TO LEGEND
182B		31	OQUAGA-ROCK OUTCROP COMPLEX, 03-08% SLOPES	ADDED TO LEGEND
182D		292	OQUAGA-ROCK OUTCROP COMPLEX, 15-25% SLOPES	ADDED TO LEGEND
182F		264	OQUAGA-ROCK OUTCROP COMPLEX, 25-65% SLOPES	ADDED TO LEGEND

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MAP SYMBOL	ACCESSORY SYMBOL(S)	AREA (ACRES)	MAP UNIT NAME	COMMENTS
184B	84B	103	SIMODA-TRUSSEL CHANNERY SILT LOAMS, 03-08% SLOPES	WAS 84B, TRUSSEL ADDED TO NAME
185Z		3	PITS, MINE	ADDED TO LEGEND, WAS SPOT SYMBOL
215D	15D	19	BLAIRTON-BERKS CHANNERY SILT LOAMS, 15-25% SLOPES	WAS 15D, BERKS ADDED TO NAME
242D	42D	21	LILY-GILPIN COMPLEX, 15-25% SLOPES	WAS 42D, CHANGE TO LILY-GILPIN
251D	151D	98	LORDSTOWN-OQUAGA COMPLEX, 15-25% SLOPES, STONY	WAS 151D, OQUAGA ADDED TO NAME
253D	53D	162	LECK KILL-HAZLETON COMPLEX, 15-25% SLOPES	WAS 53D, HAZLETON ADDED TO NAME
253F	53F	1232	LECK KILL-HAZLETON COMPLEX, 35-70% SLOPES	WAS 53F, HAZLETON ADDED TO NAME
271B	71B	45	NOLO-ERNEST SILT LOAMS, 03-08% SLOPES	WAS 71B, ERNEST ADDED TO NAME
273F	73F	2060	OQUAGA-LORDSTOWN COMPLEX, 35-65% SLOPES	WAS 73F, LORDSTOWN ADDED TO NAME

APPENDIX C

CHARACTERISTICS OF SOILS WITHIN SAMPLING CLASSES

The characteristics of soils within the sampling classes for the map unit components are summarized below. The sampling class flowchart is meant to cover all soils in the region and, thus, permits a wider range of soils to be classified into a given class than is described below. The subgroup classification of the map unit components assigned to each sampling class are given at the end of each section in parentheses.

BMD: Inceptisols without fragipans, non-skeletal, moderately deep.

This class consists of mineral soils formed in residuum or glacial till from interbedded sandstone, siltstone and/or shale; mixed igneous and metamorphic; or metamorphic parent material. Soil depth is between 50 and 100 cm and the particle-size class is fine-loamy or coarse-loamy. These soils are well drained to somewhat excessively drained and somewhat slowly permeable to moderately rapidly permeable. (Typic Dystrochrepts).

BMK: Inceptisols and Spodosols without fragipans, skeletal, moderately deep.

This class consists of mineral soils formed in residuum or glacial till from interbedded sandstone, siltstone and/or shale; sandstone; mixed igneous and metamorphic; or mixed metamorphic and sedimentary parent material. Soil depth is between 50 and 100 cm and the particle-size class is loamy-skeletal. These soils are well drained to excessively drained and moderately permeable to rapidly permeable. (Typic Dystrochrepts, Typic Haplorthods, Ruptic-Alfic Eutrochrepts).

BND: Inceptisols and Spodosols without fragipans, deep.

This class consists of mineral soils formed in residuum, colluvium, or glacial outwash from interbedded sandstone, siltstone and/or shale; sandstone; or mixed igneous and metamorphic parent material. Soil depth is greater than 100 cm and the particle-size class is loamy-skeletal, sandy-skeletal, fine-loamy, or coarse-loamy. These soils are well drained to excessively drained and moderately permeable to rapidly permeable. (Typic Dystrochrepts, Umbric Dystrochrepts, and Entic Haplorthods).

BNS: Inceptisols without fragipans, shallow.

This class consists of mineral soils formed in residuum or glacial outwash from interbedded sandstone, siltstone or shale; mixed metamorphic and sedimentary; or igneous parent material. Soil depth is 25 to 50 cm and the particle-size class is loamy or loamy-skeletal. These soils are well drained to somewhat excessively drained and moderately permeable to moderately rapidly permeable. (Lithic Dystrochrepts).

BXP: Inceptisols with fragipans, poorly drained.

This class consists of mineral soils formed in glacial till or colluvium from interbedded sandstone, siltstone, and/or shale parent material. Soil depth is greater than 100 cm and the particle-size class is coarse-loamy or fine-loamy. These soils are very poorly drained to somewhat poorly drained and are moderately slowly permeable to moderately permeable in the upper solum and slowly permeable to very slowly permeable in the lower solum. The depth to fragipans is 30 to 38 cm. They have aquic moisture regimes. (Typic Fragiaquepts, Aeric Fragiaquepts).

BXW: Inceptisols with fragipans, well drained.

This class consists of mineral soils formed in glacial till, colluvium, or alluvium from interbedded sandstone, siltstone and/or shale; or mixed metamorphic, igneous and/or sedimentary parent material. Soil depth is greater than 100 cm and the particle-size class is coarse-loamy or fine-loamy. These soils are somewhat poorly drained to well drained and are very slowly permeable to moderately slowly permeable. The depth to fragipans is 55 to 75 cm. (Typic Fragiaquepts).

CMS: Entisols, mine land.

This class consists of mineral soils formed in mine spoils from interbedded sandstone, siltstone and/or shale parent material. Soil depth is typically greater than 100 cm but may be as shallow as 25 to 50 cm. The particle-size class is loamy-skeletal. These soils are well drained and are moderately permeable to moderately rapidly permeable. Their reaction is acid or nonacid. (Typic Udorthents).

CFP: Entisols, flooded, poorly drained.

This class consists of mineral soils formed in alluvium from interbedded sandstone, siltstone, and/or shale parent material. Soil depth is greater than 100 cm and the particle-size class is fine-loamy or loamy-skeletal. These soils are very poorly drained to somewhat poorly drained and are slowly permeable to moderately permeable. They have aquic moisture regimes. (Typic Fluvaquents).

FLW: Entisols and Inceptisols without fragipans, flooded, well drained.

This class consists of mineral soils formed in alluvium from interbedded sandstone, siltstone, and/or shale; sandstone; or mixed metamorphic and igneous parent material. Soil depth is greater than 100 cm and the particle-size class is fine-loamy, coarse-loamy, sandy-skeletal, or loamy-skeletal. These soils are moderately well drained to well drained and are moderately permeable to rapidly permeable. They differ from soils in CFP mainly by not having aquic moisture regimes. (Fluventic Dystrochrepts, Fluvaquentic Dystrochrepts, Dystric Fluventic Eutrochrepts, Typic Udifluvents).

HST: Histosols

This class consists of organic soils formed in organic, and in some cases, residual mineral material that underlies organic material. Soil depth is 20 to greater than 100 cm and the organic material is predominately sapric or hemic. Underlying mineral material, if present in the solum, is loamy. These soils are very poorly drained, except for shallow to bedrock soils which are well drained. These soils are moderately slowly permeable to moderately rapidly permeable. (Typic Medisaprists, Terric Medisaprists, Lithic Medihemists).

TPD: Ultisols and Alfisols without fragipans, poorly drained, deep.

This class consists of mineral soils formed in residuum, alluvium, and lacustrine material from interbedded sandstone, siltstone, and/or shale. Soil depth is 50 cm to greater than 150 cm and the particle-size class is clayey or fine-loamy. These soils are poorly drained to somewhat poorly drained and are slowly permeable to moderately slowly permeable. They have aquic moisture regimes, or are somewhat poorly drained and are classified as having aquic subgroups. (Typic Ochraqualfs, Aquic Hapludults, Aeric Ochraquults).

TWD: Ultisols and Alfisols without fragipans, well drained, deep.

This class consists of mineral soils formed in residuum and colluvium from interbedded sandstone and/or shale; sandstone; mixed metamorphic and igneous; or igneous parent material. Soil depth is greater than 100 cm and the particle-size class is clayey, fine-loamy, or loamy-skeletal. These soils are moderately well drained to well drained and are slowly permeable to moderately rapidly permeable. Some of the moderately well drained soils may have some low chroma mottles and thus, are classified as having aquic subgroups. (Typic Hapludults, Ultic Hapludalfs, Aquic Hapludults).

TWM: Ultisols and Alfisols without fragipans, well drained, moderately deep.

This class consists of mineral soils formed in residuum interbedded sandstone, siltstone, and/or shale; or igneous parent materials. Soil depth is 50 to 100 cm and the particle-size class is fine-loamy or coarse-loamy. These soils are well drained and are moderately permeable and moderately rapid permeable. (Typic Hapludults, Ultic Hapludalfs).

TXP: Ultisols and Alfisols, with fragipans, poorly drained.

This class consists of mineral soils formed in residuum and colluvium from interbedded sandstone, siltstone, and/or shale parent materials. Soil depth is greater than 150 cm and the particle-size class is fine-silty or fine-loamy. These soils are poorly drained and are slowly permeable. The depth to fragipans is 45 to 53 cm. They have aquic moisture regimes. (Typic Fragiaquults).

TXW: Ultisols and Alfisols, with fragipans, not-poorly drained.

This class consists of mineral soils formed in colluvium, residuum, and old alluvium from interbedded sandstone, siltstone, and/or shale parent materials. Soil depth is greater than 100 cm and particle-size class is fine-loamy. These soils are moderately well drained or well drained and are slowly permeable to moderately rapidly permeable. The depth to fragipans is 50 to 75 cm. (Aquic Fragiaquults, Typic Fragiaquults, Typic Fragiochrepts). (Note: The Typic Fragiochrepts were included in this class because, if they were not frigid, they would be borderline to Fragiaquult).